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Artificial Insemination*

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The following remarks whilst they apply to a limited extent to artificial insemination in general are chiefly confined to the subject as applied to cattle breeding.

Artificial insemination is the collection of semen from the male and its introduction into the female genital tract by means of instruments so that no direct contact between male and female animals is needed for breeding purposes.

There is nothing new about artificial insemination. For centuries (probably dating back before the Christian era) it was practised by Arabs in connection with horse-breeding. Much later, in 1780, Spallanzani took semen from a dog and with it successfully impregnated a bitch. Hunter and Howe (1799) and Sims (1866) employed artificial insemination to overcome infertility in human beings. For a great many years now it has been employed by practitioners to overcome certain types of infertility, particularly in mares. As a result of the great improvement in our knowledge and in the apparatus employed, insemination can now be carried out with far greater certainty, with far greater safety and with the male and female hundreds of miles apart.

Modern improvements are in large part due to the work of Professor Ivanoff in Russia. His experiments started in 1899 and were at first confined to horse-breeding. They continued until the outbreak of the last war. Afterwards the Russian Government, recognising the potentialities of the work, retained Ivanoff and established in Moscow an experimental laboratory for artificial insemination, and excellent work has been done there. Artificial insemination on a large scale has been widely employed in the U.S.S.R. In 1930 some 60,000 mares, 20,000 cows and 100,000 ewes were artificially inseminated; in 1938 the figures had risen to 120,000, 1,500,000 and 14,500,000 respectively. In 1938, from one bull 1,536 cows were inseminated and produced 1,490 calves, whilst from one ram 15,016 ewes were inseminated and produced 15,662 lambs. Artificial insemination has been widely practised in Denmark, Holland, Italy and U.S.A., and in our colonies, especially Kenya. Reports arriving through neutral sources indicate that it has been used in Germany to an increasing extent since the outbreak of the present war. From 1935 onwards research work has been carried out at Cambridge and has chiefly embraced the storage and transporting of semen. We, as a profession, should pay tribute to the work of Walton and Edwards. Now the Agricultural Improvement Council has set up a Committee on which Professor Craig is the veterinary representative, and this Committee has decided to launch two large-scale field trials with cattle—one trial will be centred at Cambridge—the other at Reading.

Now what are the advantages to be expected from artificial insemination?

1. In countries such as Kenya, the Argentine and the U.S.S.R., where high-class bulls have to be imported, the advantages of artificial insemination are obvious when we remember that one bull can be used to inseminate 1,000 or more cows annually.

2. In this country artificial insemination would have the very great advantage of bringing the proven sire within the reach of the small farmer. In this respect it would be the biggest step forward since the introduction of the system of pedigree breeding.

3. It would do away with second-grade bulls. Pedigree breeders would of course lose their market for such animals, but they would find (as the Danish breeders found) that there would be an increased demand for top-class sires.

4. Fewer bulls will be needed and there will be a consequent saving in feeding stuffs—an important point in war-time.

5. There will be less risk of spreading certain venereal diseases of cattle. This will apply particularly to trichomoniasis.

6. Since the bull's semen will be examined regularly there will be a check on the bull's fertility. It is fairly common for a bull to become less potent and perhaps quite infertile, and where natural service is employed such a deterioration might not be detected for some time so that valuable months are lost.

7. It is easier to employ female labour on farms where no bull is kept.

8. There is a saving of the time taken up by driving cows from one holding to another where a bull is kept.

9. There is the advantage that artificial insemination will mean that better breeding and calving records will be kept.

10. Artificial insemination is perfectly safe and observations made over several generations indicate that when the operation is performed by a skilled worker no harm is suffered by parents or progeny.

11. Reasonable in-breeding can be extended. Pedigree breeding will be greatly increased. We must remember that at present only one-third of the bulls used are pedigree and even fewer cows can claim that distinction.

12. It will be possible to mate outstanding individuals which are hundreds of miles apart.

13. After the war, if artificial insemination has already been established in this country, we might find we have a valuable export trade in semen. If we are not prepared America may anticipate this demand and capture the market.

Now for the other side of the picture.

1. From the point of view of getting cows into calf, artificial insemination is no better than natural service.

2. It is not a panacea for breeding troubles. The cow suffering from endometritis is no more likely to be got into calf by artificial insemination than by natural service.

3. Artificial insemination will probably prove more expensive for the smaller farmer who uses his neighbour's bull at the small fee which commonly prevails.

4. Where no bull is kept on a farm it is sometimes more difficult to ascertain whether a cow is bulling during the winter—this applies particularly to the North.

5. One must consider the use of petrol and man-power entailed in running an artificial insemination scheme.

6. Some breeding establishments will suffer through decreased demand for their second-class sires.

7. It has wrongly been suggested that artificial insemination will lead to in-breeding. A large number of bulls would be employed at the various centres and precautions would be taken to see that a bull did not fertilise his own daughters. If one bull were kept he would not be retained for more than two years; if two bulls were kept they would be retained for a period not exceeding four years. If intended for further breeding they would then be sent to another centre right away from the district.

COLLECTION OF SEMEN

The most important and at the same time the most difficult operation connected with artificial insemination is the actual collection of a satisfactory sample of semen. Semen can be collected in a number of ways:—

1. A female may be served and semen collected from the vagina. Such a sample is probably contaminated and is diluted with vaginal secretions which have a deleterious effect on the spermatozoa and render the semen difficult to handle.

2. A sponge is inserted in the vagina, the female is mated, the sponge removed and the semen squeezed out. This method has the disadvantages that the spermatozoa are injured in the process, the sponge is difficult to sterilise and only a fraction of the semen is recovered. This method has been employed chiefly in the mare.

3. In the case of most bulls, semen can be obtained by rectal massage of the seminal vesicles and the vasa deferentia. There may or may not be protrusion of the penis; in the latter case the semen dribbles away from the sheath. The first fluid collected consists of secretion from accessory glands, followed by a concentrated suspension of spermatozoa. Not all bulls respond to this treatment, moreover any semen which is obtained is likely to be contaminated.

4. Ejaculation has been promoted in rams by electrical stimulation, a current being passed between the rectum and the lumbar region.

5. In Germany Götze has collected semen from the stallion by means of the condom, but for obvious reasons such a method is not applicable to the bull.

6. A sperm collector consisting of a rubber sac which fits the vagina and is held in position by an inflatable rubber ring, has been utilised in bovines. The collector is placed in position, the cow is served, the collector is then removed and the semen poured into a glass receptacle. When using this method there is always a risk of the bull's penis being thrust between the collector and the wall of the vagina.

* Address to the South-Eastern Division, N.V.M.A., at Tunbridge Wells, July 23rd, 1942.

7. The best method of collecting semen is undoubtedly by means of the artificial vagina which is used for the stallion, bull and ram. The following description refers to collection from the bull.

There are several patterns of artificial vagina on the market but for the bovine the handiest is probably the Russian model. This consists of a hard rubber or metal tube with a soft rubber lining slightly thicker than the inner tube of a bicycle tyre. Before assembling the artificial vagina the worker must ensure that the hands are clean and dry. The ends of the soft tube are turned back on the ends of the outer tube and fixed in position by binding with soft cord. By varying the amount of turnover the tension of the inner tubing can be adjusted. The outer tube has a hole (fitted with a stopper) through which water can be poured into the space between the outer and inner tubes. A graduated glass receptacle fits into one end of the artificial vagina, and a metal cage may be fitted to protect the glass.

The inner lining should be adjusted, the stopper removed and the space between outer and inner tubes filled with water at 55° C. from a kettle, the vagina being held in the horizontal position. The stopper is inserted. A clean dry thermometer is placed in the end of the vagina furthest removed from the stopper. By means of a clean glass rod the whole of the inner surface of the vagina is smeared with sterile vaseline. Some people use liquid paraffin instead of vaseline, but the latter is preferable in practice. Sterile liquid paraffin (2-3 c.c.) is, however, placed in the glass receptacle before the latter is fitted into position. The thermometer should register a temperature of 42° to 45° C. If the temperature is outside this range one must allow the water to cool or empty out some of the water and replace with hot water from the kettle, to adjust to the required temperature. Finally, the pressure exerted on the lining must be adjusted by holding the vagina in the vertical position with the mouth downwards and opening the stopper, when any surplus water will run away. The stopper is replaced and the apparatus dried with a clean cloth.

When the apparatus is ready the bull is led to the selected cow which may or may not be in oestrum. In the latter case an older cow is preferable; she is tied up loosely to a ring and is restrained by a man standing on either side of her. The collector holds the artificial vagina mouth downwards in his right hand and stands on the right-hand side of the cow. When the bull mounts the cow the apparatus is held behind the bull's foreleg and at an angle of 45°, with the mouth pointing downwards towards the bull's penis. The penis is directed into the vagina by the operator holding the prepuce with his left hand. Care must be taken not to handle the penis itself as this causes the bull to retract. As soon as the artificial vagina is entered the bull thrusts upwards and ejaculates. The artificial vagina should immediately be turned mouth upwards. The semen runs down into the glass receptacle and is covered and protected by the liquid paraffin. The receptacle is removed from the end of the vagina and stood upright in a wooden block. A bull should ejaculate from 2 to 8 c.c. of semen. If the bull has not been used for a week or so a second ejaculate should be collected and used for insemination. The artificial vagina can be fitted in a dummy or "phantom" cow.

Healthy bull semen is a thick milky suspension, whilst a poor sample appears to be watery. An excessive yellowish colour denotes the presence of pus. Apart from naked-eye appearance semen can be examined microscopically for motility and condition of individual sperms (abnormal spermatozoa should not exceed 10 per cent.) and more especially for the presence or absence of the wave movement of the spermatozoa. Other important tests are sperm count, using a haemocytometer (average should be about 800,000 per c.mm.), *p*H test (should lie between 6·8 and 7·2) and respiration test. This latter test is based on the fact that spermatozoa utilise oxygen and the amount taken up is a measure of the sperm activity.

The cow to be inseminated has its vulva and perinaeum carefully washed, using plain water. The vagina is dilated by means of a tubular or Russian speculum and ½ to 1 c.c. of semen is introduced into the cervical canal, using an inseminator. Quite an effective instrument consists of a 1 c.c. all-glass syringe fitted with a vulcanite extension.

If the semen has to be transported or stored it is pipetted into small glass tubes (sufficient semen for one cow in each tube). The space above the semen is occupied by sterile liquid paraffin and the tubes are stoppered. These small tubes are then wrapped in cotton wool and placed in a larger corked tube which is immersed for 30 min. in water cooled with ice and afterwards this large tube is stored in a Thermos flask containing chipped ice. In this way semen can be stored up to 72 hours. When being transported the Thermos flask can be surrounded with corrugated cardboard or packed in a box containing cotton wool or wood shavings. When required for use the large tube is removed from the Thermos flask and allowed to stand at room temperature for 30 min.

A fairly recent development is to place sufficient semen for one cow in a gelatine capsule. These capsules are coated with wax and when required for use they are inserted into the cervical canal by hand or by means of a special gun. More recently semen has been actually incorporated in gelatine pessaries.

Where a large number of animals are to be inseminated from one ejaculate the semen can be diluted. Various dilutors are used, a suitable one consisting of a glucose-phosphate mixture, one part of semen being diluted with an equal volume of the dilutor. At the present time there is no call for diluting semen in this country.

I did intend dealing with the setting up and running of an artificial insemination centre but much of this aspect of the subject can be dealt with in any subsequent discussion. Suffice it to say that a centre should serve a radius of 10 to 15 miles and one bull should be allowed for every 1,500 cows. Semen would be collected early in the morning and the requests for insemination should be received by 10 a.m. when the inseminator would set out on his rounds. He would take extra supplies of semen so that he could, where practicable, deal with any requests received at previously selected points on his route. Any cows coming into oestrum in the evening can be inseminated the next morning.

I will conclude by asking the opinion of the meeting as to what part it considers the veterinary profession should take in this work. There are many reasons why it should at least be supervised by veterinary surgeons but we must remember that agriculturalists have generally attended to breeding in the past and artificial insemination is merely a further development. An argument in favour of the veterinary profession taking charge of insemination schemes is the attention necessary to the health of the bull and the cows inseminated, but surely the veterinary practitioner can continue to attend to these animals as he has done in the past.

Without expressing an opinion I do think we, as a profession, should decide whether or not this work comes within our province. If we conclude that it does we must be prepared to play our part from the beginning and thus avoid the unpleasant consequences of a belated interest, which would assuredly include the ousting from position of other workers already deeply entrenched.

Artificial Insemination and the Veterinary Surgeon, with Special Reference to Cattle*

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The purpose of this paper is to review the development of artificial insemination, to discuss the possibilities of organised artificial breeding in Great Britain and the problems which it raises, and to indicate the status of the veterinary surgeon in regard to the practice of the technique.

Historical Review.—In order to get the subject in its proper perspective, it may be instructive to preface this address with a brief review of the historical aspects of artificial insemination and so assign it to its proper place in scientific discovery. It has been said that artificial insemination is the most striking advance in animal husbandry of recent years. This statement with certain reservations is no doubt true, but it should not be misconstrued as implying that artificial insemination is an entirely modern discovery.

The earliest account of artificial insemination in the domesticated animals to be found in English scientific literature is given in a paper published by Heape in 1897. According to this author, who cites Le Bon as his authority, there is some evidence that the method was known to the Arab horse breeders as early as A.D. 1300. The first authentic record of its use in mammals was by the Italian scientist, Abbé Spallanzani, who successfully inseminated a bitch about 1780. It is interesting to note, however, that Spallanzani did not discover the fundamental mechanism involved, for he attributed the fertilising power of the semen, not to the spermatozoa, but to the liquid part of the semen. It was not till about the middle of the last century that the spermatozoa was recognised as the essential element in the male contribution to fertilisation.

From Spallanzani's time until the end of the nineteenth century few attempts were apparently made to use artificial insemination; this was in some measure due to moral and religious objections. Between 1884 and 1896, Heape records that Sir Everett Millais carefully repeated Spallanzani's experiments and out of a total of 19 bitches inseminated 15 conceived. During this period occasional references are made in both veterinary and medical literature to the use of artificial insemination as a means of overcoming sterility. Thus in the *Veterinarian* of 1898, Heape recommends its use in the mare in cases of sterility due to inflammatory conditions of the cervix, abnormal vaginal secretions, closure of the os or post-coital extrusion of the semen, and many veterinary surgeons have since practised this procedure in individual mares, known to be "shy breeders," with some success.

The basic research which led up to the modern development of artificial insemination was commenced by the Russian physiologist, Elie Ivanoff, about the year 1899. In 1907 Ivanoff reported the results of a series of successful

* This paper formed the basis of an address given to the Central Veterinary Society, London, on October 1st, 1942.

inseminations in mammals, following which the practical possibilities of the method began to be recognised. A laboratory was established in Moscow in 1909 for the purpose of training veterinarians in the technique, and by the outbreak of World War I in 1914 fairly extensive work had been carried out in Russia in the breeding of horses and in the hybridisation of wild and domestic species. In 1919 the Soviet Government in an effort to improve the status of its livestock industry founded the Moscow Central Experimental Breeding Station, with Ivanoff as Director, for research into the problems of animal reproduction. Active work on artificial breeding in the field began in 1923; from that date spectacular progress has been made, and prior to the outbreak of the present hostilities millions of cattle, horses, sheep, goats and pigs in the U.S.S.R. were being bred in this way.

The first detailed account of the modern development and technique of artificial insemination to be published in Britain appeared about ten years ago. This was a monograph by Walton (1933), of Cambridge, in which was incorporated a large amount of data on the artificial insemination of cattle and sheep reported by Russian workers (Kusnetzova* *et al.*, 1932). Although Walton's publication attracted little attention at the time in veterinary circles in this country, tribute must now be paid to this worker for making known in Britain the work which had been carried out in Russia. In addition, Walton and his co-workers at Cambridge have conducted much fundamental work on the technique of artificial insemination and on the physiology of spermatozoa. Walton himself is acknowledged to be one of the leading world authorities in this field.

In the last few years a vast literature has accumulated on all aspects of artificial breeding. The subject had assumed such importance that, prior to the outbreak of the present hostilities, numerous conferences of workers mainly or solely concerned with this field of research had taken place in various countries. As a result of this intensive study, new and better techniques have been devised for the collection of semen and for the handling of semen after collection. Concurrently, much knowledge has been acquired concerning the biology and physiology of sperm cells, though much work still remains to be done on this aspect. Perhaps the most important of the recent developments has been the preservation of the viability of sperm in storage and its transport for experimental tests over long distances.

The Uses of Artificial Insemination

The possible uses to which artificial insemination may be put can be grouped under two main headings :

(*a*) Livestock Improvement.

(*b*) Disease Control and Breeding Efficiency.

In most of the countries where artificial breeding has been adopted on a large scale, livestock improvement has been the main motive, but in one or two tropical or sub-tropical areas disease control has been an equally important incentive. I shall refer again to this later when considering the progress which artificial breeding has made in various countries.

Livestock Improvement.—In most countries of the world there is a considerable difference between the performance, whether for meat or milk production, of the best animals and that of the average. This is particularly true of milk production where we are dealing with a commodity which can be accurately measured, and it is generally acknowledged in Britain that the milk yield of our national herd could be greatly improved by the more widespread use of first-class dairy bulls. But the number of such sires at any given time is limited and, therefore, the desired progress must of necessity be slow with the methods applied up to the present. By the use of artificial insemination, however, it is possible to mate superior sires with many times the number of females than would be possible under natural conditions. An example of what can be done in this respect has been reported from Russia, where in one year 1,536 cows were inseminated from the semen of one bull and produced 1,490 calves and 15,016 ewes were inseminated from one ram and produced 15,662 lambs (Liskun, 1941). In one of the Danish breeding societies an outstanding bull was mated with about 900 cows during a single year (Rice, 1942). These figures probably represent the extreme limits, and it is not claimed that comparable numbers will be desirable or practical for routine organised breeding under the system of animal husbandry in practice in most countries.

Another advantage of artificial insemination is that the small dairy farmer can avail himself of the services of superior sires which under present conditions are available only to the owners of large herds, for when the purchase and maintenance costs of a valuable sire are distributed amongst a large number of small owners, as in an organised artificial breeding association, the individual cost is low.

One very obvious problem which arises when considering this aspect of artificial insemination is as to what constitutes a first-class sire. In theory there is only one answer, namely a proven sire, *i.e.*, one whose ability to transmit desirable characteristics is known. In dairy cattle breeding, most sires are never proved because they have been destroyed before their worth has become known. Under present conditions, a bull has reached the age of five or six years before even the first of his daughters comes into production and it would take a few more years before there was a sufficient number of daughters to indicate whether the sire was transmitting milking ability or not. Quite obviously few individual farmers can keep one bull for this length of time, for in the average herd it would mean that the bull would have to be used on his own daughters. With co-operative artificial breeding, on the other hand, it is possible to have a sufficient number of daughters to prove a bull *earlier* than under natural service conditions, and no individual owner need have more than one or two females bred to the bull before he is proven, and so greatly distributing the risk of the bull turning out a failure. Thus organised artificial breeding may produce an entirely new concept of what a proven bull is, for we can expect to judge him on say 100 daughters rather than on five to ten, as is done under present conditions.

Storage and Transport of Bull Semen.—Problems involving the storage and long distance transportation of bull semen are being investigated both in the U.S.A., in this country and elsewhere. Thus Edwards *et al.* (1938) report that in an exchange of bull semen between England and Holland, eight of 26 cows conceived ; the maximum age of the semen used in this case was 57 hours. Investigators in the U.S. Bureau of Dairy Industry have shipped bull semen from Beltsville to Buenos Aires, Argentina, and it is reported that at least one successful impregnation was obtained (Lambert and McKenzie, 1940). In this experiment seven days elapsed between the time of collection of the semen and insemination. During the last few months I have been sending numerous samples of semen from Reading to Lancashire and to the Isle of Man, and at least four cows have been successfully impregnated with semen which had been collected 48 hours previously. There are still many practical difficulties to overcome in the long distance transport of semen, but the experiments I have quoted show that the mating of widely separated animals is now a definite possibility. One development of this may be that, after the cessation of the present hostilities, we in this country will be called upon to export semen to the Continent of Europe in order to replace valuable sires lost in the livestock reduction which has taken place there since 1939. Personally, I am not as sure about this as are some who have recently expressed this view, because of the difference between our breeds and those of the Continent, and also because it is more likely that the authorities in the countries concerned will utilise their own native bulls for artificial insemination purposes.

Disease Control and Breeding Efficiency.—Since in the modern technique of artificial insemination there is no actual contact between the male and the female, the danger of disseminating certain contagious diseases, usually spread by coitus, is eliminated. In this group of diseases are trichomoniasis, infectious vaginitis and possibly contagious abortion and corynebacterial metritis—all diseases which occur in Great Britain.

The hazard of the bull acting as a disseminator of genital disease applies within a herd, but it is unquestionably greater where communal or inter-herd sires are operating. In the case of bulls which are to be used by co-operative artificial breeding societies a stringent veterinary examination of the animals will be necessary to ensure that they were free from transmissible genital diseases.

As an example of the use of artificial insemination for disease control within a herd, the case of trichomoniasis may be cited. Here, if the disease is well established, it is almost certain that the bull will harbour the infection. In the bull, treatment of trichomoniasis is likely to be protracted and during this time the bull is unfit for service. In order to permit the resumption of breeding operations, it will be necessary to use a clean bull ; but since it is usually difficult to say *with certainty* that any particular cow after appropriate treatment is free from infection, the risks of transmitting the infection to the clean bull are obvious. In such a case, the adoption of artificial breeding for a time will ensure that the clean bull is protected from exposure to infection, and by so doing, the continued dissemination of the disease in the herd will cease.

Artificial insemination may also be utilised to overcome difficulties in breeding caused by deformities and abnormalities in the genital tract of the cow, *e.g.*, occlusion or induration of the cervix. I wish to cite an example to show that artificial insemination does have an application of some value in this type of sterility (Scorgie, 1942). A very valuable pedigree cow, after her fifth calf, was served 16 times by the natural method over a period of 654 days without conception resulting. Heat periods were normal. The cow had been subjected to uterine irrigation on several occasions and had also received hormone treatment. At this stage I saw the cow, and on examination she appeared to me to have a partial occlusion of the os cervix, through which the annular rugae of the cervical canal were protruding. In view of her previous history I, not very hopefully, suggested artificial insemination. The cow held to the first insemination and produced a full-term calf. One or two other cases of a similar type

* Kusnetzova, Milovanov, Neumann, Nagaew & Skatin. (1932.) "Artificial Insemination in Cattle and Sheep." Moscow.

have also been successfully bred by artificial means, but, on the other hand, it must be acknowledged that in a fairly large number of instances artificial insemination has been no more successful than natural breeding. Nevertheless, with a valuable cow which fails to breed after repeated services and in the absence of any very obvious disease or abnormality, it does seem to me that artificial insemination should be tried before sending the animal for slaughter.

Finally, the cause of low breeding efficiency in a herd may be due to the use of a bull of low fertility. It is not possible to say with what frequency this occurs, but experience indicates that it may be more common than is usually suspected. Thus, for example, it has been found that a bull may cease to produce spermatozoa of good quality and becomes, therefore, incapable of getting cows in calf. In most cases this form of sterility is of a temporary nature, and under rest and treatment normal reproductive function will return. Usually, before the bull has been suspected a number of cows may have been served without their conceiving, thereby causing a not inconsiderable disturbance in the owner's breeding programme. The reason for this temporary stoppage in the production of good quality sperm is unknown, but the majority of cases we have met with have occurred during the months January to March. It has been suggested that it is related to some deficiency in the diet, possibly vitamin C (Phillips, 1940). With the co-operation of a number of practitioners I have been carrying out a trial of the therapeutic value of injections of ascorbic acid in suitable cases of sterility in bulls, and in one or two instances treatment has caused an apparent recovery in the bulls' breeding capabilities. Our series of cases is as yet, however, too small to make any final comment on the value of this form of treatment (Scorgie, 1942).

I am not, of course, suggesting that artificial insemination is a remedy for sterility in the bull, but as soon as the bull becomes suspect no time should be lost in having his semen examined. The only way to obtain a satisfactory sample of semen for this purpose is by means of the artificial vagina, which is normally used for collecting semen for artificial insemination. By submitting the semen so obtained to certain diagnostic tests it is sometimes possible, but not always, to say with certitude that the semen of the bull in such a case is of low quality.

I want to make it clear that I am not advocating artificial insemination as a remedy for all the reproductive disorders of cattle. This is far from being the case, and its indiscriminate use for this purpose could only bring the practice into disrepute. When it is used *rationally and in conjunction with expert diagnosis*, artificial insemination can play an important role in the control of certain well-defined reproductive diseases of cattle. For this reason, it is my firm conviction that its use under large scale field conditions should be in the hands of the veterinary surgeon.

Possibility of Sex Control.—I would like to end this section dealing with the "Uses of Artificial Insemination" on a speculative note. This concerns the artificial determination of sex by the separation of the male- and female-determining sperm. Such a possibility has been, and still is, a favourite theme of all kinds of chicanery and pseudo-science. Some recent work, particularly in the U.S.S.R., indicates a serious possibility that the problem may be solved by the method of electrophoresis, *i.e.*, the passage of an electric current through a suspension of sperm, causing an accumulation of the male-determining sperm at the cathode and the female-determining sperm at the anode. There are still many technical details of the process to be worked out, but it would be a bold man who denied the possibility of a solution of the problem within the next 10 or 20 years. The importance of such a discovery for the dairy and poultry industries would be profound.

Organised Artificial Breeding

Organised artificial breeding on a large scale was first developed on the collectivised farms of the *U.S.S.R.* The concentration of large numbers of cattle and other animals at or near one place facilitates breeding in this way, and the conditions peculiar to Russian stock-raising enabled phenomenal progress to be made in the application of artificial insemination to practical conditions. Some idea of the scale on which artificial breeding is practised in the U.S.S.R. is got from a recent report which states that by 1938 fifty million farm animals had been inseminated. It is also claimed that the utilisation of large-scale artificial breeding has greatly speeded up livestock improvement and facilitated the introduction of new species. (Liskun, 1941.)

Outside Russia, breeders of dairy cattle in *Denmark* were quick to realise the possibilities of artificial insemination, and in that country rapid progress has been made in the development of organised artificial breeding. The first co-operative artificial breeding society was formed at Samso in 1936, and by 1941 there were 85 such societies throughout Denmark, each with a cow entry of from 1,000 to 3,000. One or two special veterinarians were employed at each centre; in addition to the insemination work these veterinarians also carried out pregnancy diagnosis and the treatment of sterility. (Walton & Edwards, 1942.)

Concurrently with the early work in Russia, a limited amount of research appears to have been carried on in *Italy*. Thus the first investigator to use the artificial vagina for the collection of semen was apparently the Italian physiologist, Amantea, who collected semen from the dog as early as 1914 by means of this device. The first big step towards organised breeding in Italy was taken in 1937 with the setting up of two institutes under Government auspices to study the techniques of artificial insemination and related breeding problems. By 1939 there were 100 subsidiary artificial breeding centres throughout the country, 80 per cent. of their work being concerned with cattle. It is reported that in the years 1938 and 1939 about 20,000 animals were inseminated. (Bonadonna, 1939.)

In *Kenya* experiments on artificial insemination of sheep and cattle commenced in 1935. During 1938 and 1939 rapid extension of this method of breeding took place, mainly on account of the prevalence of genital disease transmitted by coitus. The practical application of artificial insemination to both cattle and sheep on European-owned farms is carried out by the farmers themselves, who receive instructions in the technique at the Experimental Station, Naivasha. About 12,000 cows are now being inseminated per year in Kenya with satisfactory results.* (Anderson, 1939.)

In the *U.S.A.* artificial breeding on organised lines first came into being in May, 1938, through the co-operation of the New Jersey State College of Agriculture and the New Jersey Holstein-Friesian Association. (Bartlett & Perry, 1939.) Ninety farmers owning some 1,000 cows entered the original scheme and employed a full-time veterinarian to carry out the insemination work. The success of this enterprise was outstanding, and within 18 months it comprised approximately 5,500 cows and employed six veterinarians. Elsewhere new associations were formed and by the summer of 1940 a survey showed that approximately 50,000 cows owned by 4,000 to 5,000 dairy farmers in 22 states were enrolled in 54 artificial insemination associations. It is conservatively estimated that nearly 100,000 cattle were artificially inseminated in 1941. (Rice, 1942.) Dairy cattle breeders in the U.S.A. have clearly recognised the economic benefits and other advantages of artificial breeding, and almost without exception the American associations have arisen as a result of a real demand for this service by the breeders themselves. It is of some importance to realise this fact because one British critic of the method has said recently, "At the present time artificial insemination seems to be something of a propaganda toy to the scientists, who are its principal advocates." In the U.S.A. at any rate this statement is very far from being the truth.

Fees in the American associations range from £1 to £2 per cow inseminated, plus an original membership fee of similar amount. The bulls are usually selected by a committee of breeders whose judgment has the respect of other farmers in the community. All sires are submitted to stringent examination before they are purchased or leased; they are required to undergo diagnostic tests for disease and their semen is examined to assess its potential fertility. It has been found that each unit of approximately 1,000 cows requires at least two or three bulls. Since some of the best bulls are well advanced in years, great attention is paid to their feeding, management and exercise, in order that they may be kept in service for the longest possible time. The proper care of the bulls is one of the duties of the veterinary surgeon responsible for the management of the breeding centres.

It is interesting to note that the close supervision of the bulls and the frequent examination of their semen has shown that a bull for unknown reasons sometimes temporarily ceases to produce spermatozoa and thus becomes infertile. This must also undoubtedly happen in the natural service method, but since in this case there is no ready means of examining and checking the quality of the semen, the fact either passes unnoticed or sterility is wrongly attributed to the cows.

A new development in some of the more recently formed artificial breeding associations in the U.S.A. is the "herd health service," which is worked in conjunction with the artificial insemination scheme. The "herd health service" undertakes the routine examination of herds and broadly resembles the N.V.M.A. Panel Scheme in regard to the diseases and conditions treated. (See Rice, 1942.)

In addition to the countries which have been mentioned above, organised artificial breeding of cattle and sheep is being carried on in several European countries, in the British Colonies, and at the present time its use is being considered in some of the South American countries. The special problem which has been the main factor in the adoption of organised artificial breeding varies in different countries. In Russia and, to a lesser extent, in some of the British Colonies, where there is a relative scarcity of suitable sires, the need has been to secure the impregnation of the maximum number of females from such sires as are available. In Italy and in Kenya, on the other hand, it would appear that the stimulus to the method arose from a need to combat genital diseases spread by coitus, which are said to be unusually prevalent in these countries. In the U.S.A. and in Denmark the main object has been to provide dairy breeders, especially those with small herds, with the use of outstanding sires which otherwise they would have been denied on economic grounds.

Great Britain.—Having briefly surveyed the uses of artificial breeding in other countries, it becomes pertinent to enquire whether the method could profitably be adopted in Britain on organised lines (see also Scorgie, 1942).

Artificial insemination schemes will probably hold no attraction for the professional pedigree breeder, but for the smaller farmer they

* See also article by J. Anderson in this issue.

undoubtedly present a great opportunity to obtain, at a low cost, the use of first-class sires. It has recently been stated by a leading official of the Milk Marketing Board that one-half of the milk produced in Britain comes from herds of twelve cows or less. In such circumstances, therefore, the keeping of a bull by each small farmer is clearly uneconomic. The alternative is to obtain the services of a communal bull and this is, in fact, what is usually done. But, as veterinarians well recognise, the communal bull is one of the most important factors in the dissemination of genital disease in districts where this method of service is a common practice. Artificial insemination would remove this hazard.

Another point of considerable importance to the small farmer is the time taken up in taking his cows to the bull; in the aggregate this must represent a considerable number of man-hours of a farmer's time. Properly organised artificial breeding schemes would eliminate this waste.

The application of artificial insemination on organised lines in Great Britain undoubtedly offers great possibilities in livestock improvement in that it would provide the small farmer with the use of a much better sire than he could own individually. In the case of milk production this might lead in, say, five to six years, provided the bulls had been well chosen, to a considerable increase in the average yield of the national herd. An additional advantage to the non-pedigree breeder would be the opportunity of grading up his stock with a view to possible registration in the case of those breed societies which have open herd books.

Possible Objections.—It has been suggested that the institution of organised schemes for artificial breeding will adversely affect the sale of pedigree bulls in Great Britain. Judging by what has happened in Denmark and the U.S.A. there may be little foundation for this belief. On the contrary, it has been stated that the trade for really first-class bulls has improved, since the societies are in a position to pay good prices for the best animals (Walton, Edwards and Hammond, 1940). Another aspect is that the owner who is grading up his herd through artificial insemination will be provided with an incentive to acquire pedigree heifers, so that the trade for these would be more likely to improve than to diminish.

In connection with the bull trade at present, one breed society at least has had the courage to admit that too many bull calves are being reared on account of the possibility that they will fetch high prices. "Many of these bulls have little or nothing to recommend them. All they accomplish is to lower the general, to increase the total of second-rate cross-bred cattle, and to reduce values for all." That is a quotation from a recent number of the official journal of the breed society in question. The implications of the statement are clear, and it is my view that artificial breeding schemes would do much to check the tendency to the absurdly high prices now being paid for what are likely to prove in many cases inferior sires. Furthermore, such schemes would perhaps do much to eliminate the risk that after the war prices will drop, and pedigree breeding suffer a set-back as bad as that after the last war.

In some quarters the fear has been voiced that artificial breeding will give rise to possible abuse in regard to false statements concerning the paternity of animals offered for sale or registration. A consideration of the facts, however, will show that this objection is hardly valid, for it is just as easy for the unscrupulous breeder to effect substitution under natural breeding methods. That false representation of this kind occasionally now takes place is undeniable, but it is a tribute to the integrity and honesty of the pedigree breeder that it does not occur more often. Adequate precautions have already been taken by five of the dairy breed societies* to ensure that the collection of semen and its insemination is carried out by an approved authority. Three of the societies stipulate that collection and insemination shall be carried out by, or under the supervision of, a qualified member of the veterinary profession (or other approved authority).

In the case of organised artificial breeding schemes dealing with small herds where there is no bull, it is obvious that there is little or no opportunity for fraudulent statement in regard to the sires.

Possible Legislation.—Further safeguards to prevent possible abuse are foreshadowed in a recent statement made in Parliament by the Minister of Agriculture. Mr. Hudson said that the Agricultural Improvement Council had expressed the view that in order to avoid jeopardising the successful establishment of the practice, steps should be taken to prevent its indiscriminate exploitation. Accordingly he proposed to ask Parliament at the first convenient opportunity for powers to control the practice of artificial insemination by specifying the conditions under which it might be employed, and by restraining its use to properly authorised persons in all cases, except when the animals to be inseminated were in the same ownership as the sires providing the semen.†

In my view there is every need for close scrutiny of bulls to be used for large scale artificial breeding, both in respect of their quality (*i.e.*, milk-transmitting capabilities) and their fertility. This method of breeding places a heavy responsibility on a bull because of the great increase in his progeny which it makes possible, and if the quality or fertility of the bull is poor, the harmful influence which this can exert is multiplied many times over that which appertains to natural breeding. It would appear, therefore, that the proposed legislation should take into consideration the status of bulls which are to be used in artificial insemination schemes.

As to what the definition of a "properly authorised person" will be, remains to be seen. I would, however, seriously suggest, and bearing in mind all the implications, that a veterinary surgeon can be so described. The successful application of artificial insemination, especially on a large scale, will depend ultimately on a knowledge of the genital health of the animals concerned. Its widespread use on animals which are suffering from genital diseases, which either temporarily or permanently render them incapable of breeding, can only bring the practice into disrepute. It seems, therefore, that the veterinary surgeon, by the nature of his training and experience, is the person best fitted to carry out or supervise the work of organised artificial breeding, and I would point out that this fact has been recognised in Russia, Denmark, the U.S.A., and in most countries where this method of breeding is carried on. I want to make it clear, however, that I am not suggesting that all aspects of artificial insemination work, and in particular that of research, require to be done by the veterinary surgeon. There are others outside the profession who are better qualified to conduct research into such matters as the physiological and biochemical properties of spermatozoa, to deal with the inheritance of milk and other characteristics, and to advise as to the type of animal which shall be used for the artificial breeding schemes.

The Development of Artificial Insemination Schemes in Great Britain

Official Schemes.—For some time it has been evident that there exists amongst dairy farmers, especially those with small herds, a considerable interest in the practical possibilities of applying artificial insemination to conditions in this country. Being aware of this interest, the National Institute for Research in Dairying, Reading, and the School of Agriculture, Cambridge, submitted proposals to the Ministry of Agriculture towards the end of 1941 for the formation of artificial insemination centres at each of these places. Although the approach to the Ministry was first made by two agricultural institutes, these proposals in each case had the backing of a considerable number of practical breeders in their respective districts. I think it fair to state, therefore, that the true stimulus for the formation of artificial breeding centres has come from the breeders themselves and not, as has been alleged, from the agricultural scientists.

The Ministry referred the proposals submitted to it to the then newly formed Agricultural Improvement Council—a body whose function is to see that the results of scientific research are made known to the ordinary farmer, and given greater opportunities of establishing themselves in everyday practice. The A.I.C. accepted the proposals, and also set up a special sub-committee—the Artificial Insemination Supervisory Committee—to explore the possibilities of establishing artificial breeding on organised lines in Great Britain. (Both the A.I.C. and the Supervisory Committee include veterinarians amongst their members.) So far, only the schemes at Reading and Cambridge have received official approval, and they are to be regarded as field experiments in so far as they will provide information on the running and organisation of artificial breeding schemes. In the future it is anticipated that other similar schemes will be approved for suitable areas.

Private Schemes.—In addition to the Reading and Cambridge Schemes which have the official approval of the Ministry of Agriculture, at least one privately sponsored scheme has been formed. The work in this scheme also is to be carried on under the supervision of a veterinary surgeon.

I understand that the formation of other schemes is under consideration in various parts of the country. The advisability of private schemes is a moot question which I do not propose to argue here. The official attitude of the Ministry of Agriculture would appear to be that, provided such schemes are carefully safeguarded, there can be no objection to their formation. As a purely personal expression of opinion, I think it would be wise, however, where further schemes of a private nature are contemplated, for the promoters to await, at any rate, for the time being, the legislation which the Minister of Agriculture has indicated to be at present under consideration.

Schemes Sponsored by the Breed Societies.—It is a common misconception that the cattle breed societies are opposed to the practice of artificial insemination. The truth is that some of the dairy breed societies at any rate have realised the potentialities of this method of breeding for the improvement of livestock, and provided strict rules are adhered to the Ayrshire, British Friesian, English Jersey

* Ayrshire, British Friesian, English Guernsey, English Jersey and Shorthorn Cattle Societies.

† These measures are embodied in Clause 16 of the Agriculture (Miscellaneous Provisions) Bill, 1942, now before the House.

and Shorthorn Societies are prepared to accept the registration of calves born as a result of artificial insemination. The English Jersey Cattle Society are sponsoring a scheme whereby the services of approved Jersey bulls can be made available to members, particularly those with small herds and who might otherwise be compelled to use bulls of other breeds. A number of veterinary surgeons are already co-operating with the Jersey Society in this work. The Council of the British Friesian Society are also now considering what steps the Society can take " in improving small herds by artificial insemination with semen from some of the best bulls of the breed."

Artificial Insemination in Private Herds.—I would now like to refer to the position of the veterinary surgeon in regard to artificial breeding carried on as a routine measure in a private herd. The reason for the adoption of this method of breeding may be to check the spread of genital disease spread by coitus. In a large herd the veterinary surgeon is immediately faced with the time element, in that he may be called upon to inseminate a cow at any time, and the number of calls may be such that he cannot possibly undertake the routine insemination of all cows in the herd. I will cite an example of what I mean which has recently come within my own experience. In order to check an outbreak of *Trichomonas* infection in a large herd consisting of seven bulls and some 200 cows and heifers it was decided, in co-operation with the owner's veterinary surgeon, to institute artificial breeding. The veterinary surgeon in question commenced the work, but he very soon found that if he was to continue it he would have to neglect the other work in his practice. What then was to be done ? The only possible solution was that the head herdsman would have to be taught the technique of artificial insemination, so that the work could proceed without interruption. Rightly or wrongly from the strictly professional point of view this was what was done because the practitioner did not want to lose a valuable client in respect of other professional services. The important fact which I want to impress is that whilst the practitioner had handed the *routine* breeding work over to the herdsman, he himself, nevertheless, was able to keep it closely under his own supervision. He was there, when necessary, to straighten out difficulties that might arise, he made regular visits to examine the bulls' semen and to see that the treatment was being carried out according to his instructions.

The example which I have cited is probably an extreme case in regard to the size of the herd involved. In smaller herds and where only occasional inseminations of " shy " breeders are required, the veterinary practitioner can usually carry out all the work himself. This I know is being done already, and in the last six months we have been gratified to demonstrate at the Royal Veterinary College the technique to well over a dozen practitioners who are contemplating taking up the work in their own practices.

Conclusions

1. It would appear that artificial breeding on organised lines can be an important contribution to the future improvement of livestock, particularly dairy cattle, in Great Britain. The practice presents definite advantages to small herd-owners, in that it makes available to them the use of bulls of outstanding merit, which individually they would be unable to obtain on financial grounds.

2. Artificial insemination has a place in veterinary practice, particularly in the control of certain genital diseases of cattle transmitted by coitus.

3. The success or otherwise of artificial breeding schemes for cattle will depend ultimately on the status of the genital health of the cows inseminated. The indiscriminate breeding of cows suffering from various reproductive disorders could only bring the practice into disrepute. It is essential, therefore, that the large-scale work on artificial insemination shall be carried out by a veterinary surgeon, or shall be under his direct supervision.

4. There must be adequate safeguards for the guarantee of pedigree in the case of progeny to be entered in herd books. This is a matter for the breed societies concerned, some of which have already drawn up stringent rules in respect of animals born as a result of artificial insemination.

5. Since the potentialities of a sire for good or evil are multiplied many times by artificial insemination it is essential that the health and the genetic worth of sires so used be submitted to the most careful examination.

6. Whilst the technique of semen collection and its insemination has been proved to be adequate, much research still remains to be done on the physiology of spermatozoa. Allied to this is the problem of certain conditions in the female genital tract which appear to be inimical to spermatozoa. Future developments in this field will result from the co-operation of veterinarians and workers in the allied sciences.

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Discussion

The discussion was opened by Mr. H. Bell, of Maidenhead, who said that he would like at the outset to thank Mr. Scorgie for his lucid description of the development of artificial insemination. He felt, furthermore, that the profession owed Mr. Scorgie a great debt for the work he had done on that subject and for the help he had so readily afforded enquiring members who had been called upon to do that work. (Applause.) He was confident that Mr. Scorgie had been labouring behind the scenes in anticipation of what he had seen to be coming.

There had been a difficulty in getting the necessary instruments and Mr. Scorgie's hints on improvisation had been of great help in this connection.

The essayist had given a very vivid description of the uses to which they might put artificial insemination in the control of certain diseases, and he thought all country practitioners should make themselves *au fait* with the technique of collecting semen.

With regard to the second use to which Mr. Scorgie contended that artificial insemination might be put, *i.e.*, the improvement of breeds, he did not think that the essayist had shown them quite how livestock was to be improved by the use of artificial insemination in breeding centres. He believed the interest in this practice originated in Russia: until a few months ago they knew little about the people of Russia, much less what conditions prevailed amongst the dairy cattle of that country —did we know now why the authorities thought it wise to adopt such a scheme, and what evidence there was of resultant improvements in the dairy stock ? When one took into account that there were probably more good-class bulls to the square inch in this country than there were to the square mile in Russia, the practice might conceivably bring about improvements there, which they could not hope would follow its introduction here.

With regard to the artificial insemination of cows which were shy breeders, he must confess that he had practised it on occasions, but was it desirable to perpetuate the strain of a cow that could not breed without the aid of artificial insemination ? As to the improvement of dairy stock, the great difficulty he could see was as to what constituted a proven sire. Nobody denied that the number of calvings to a particular bull could be increased, but if you were not going to breed along right lines, the chances were that you might do incalculable harm to a particular breed. You could not decide what was the best bull to use until he was several years old—Mr. Scorgie admitted that—and from his (Mr. Bell's) experience of artificial insemination in country practice, you were going to find it very difficult to get bulls accustomed to normal service to serve into an artificial vagina. His experience had been rather disastrous in that respect. He had a very fashionable bull in his practice, and he had had applications from long distances to collect semen from this bull. Mr. Scorgie kindly instructed him in the technique on the first occasion and he had been wondering whether he did not do it in the same spirit in which he (the speaker) sometimes gave a Siamese cat a pill—*i.e.*, when he knew that somebody else would have to give the next one. (Laughter.) He found it increasingly difficult to get this bull to serve into the artificial vagina, and now he had refused even to serve his cows —so that had finished semen collecting on that farm.

Continuing, Mr. Bell said that Mr. Scorgie seemed to be quite happy about the technique of sperm collecting and he (Mr. Bell) bowed to his experience, but he did wonder whether the instruments they were using were the best for the purpose: it seemed to him that the artificial vagina might very well be made in more than one size, because whilst he could collect from a Friesian bull with the greatest of ease, with Jerseys the standard size seemed too clumsy at times. He had been wondering whether the Swedish pattern vagina which fitted into the cow would not interfere less with some of these old bulls than the pattern which they were using. He advised busy practitioners to be wary about taking on this sperm-collecting job.

This was the sort of thing which was likely to happen to you. You heard that a certain herd required semen from a certain bull. The herd might be 70 miles away and you were warned that the cow would probably come into oestrum next Saturday or Sunday. What usually happened was that you kept yourself near home to be within call when required. The cow did not come bulling until the Monday, when you had forgotten all about it: then you received a ring in the early hours of the morning to collect and despatch the semen with all speed as cow has been on all night. You got together the necessary tackle and made your way to the scene of action where you might find the bull reluctant to do what was required of him: when you had been standing for an hour with a watch in one hand and an artificial vagina in the other, your hair and ears full of cow dung, you would not find much consolation with Milton in thinking that " they also serve who only stand and wait."

Dr. S. Bartlett (N.I.R.D., Reading), who was called upon by the President to continue the discussion, said that at the outset of his remarks he would like to express appreciation for the opportunity afforded him of attending that meeting: he had enjoyed the paper very much indeed. He was particularly interested in artificial insemination of the dairy cow as opposed to the title of the paper. What struck him during the course of the meeting was that, at any rate, although the war had done all kinds of unhappy things, for them it had done one good thing, in that it had brought the Royal Veterinary College to the vicinity of Reading, and that move had

been responsible for numerous new contacts which he considered of great value and he hoped the contacts were mutually useful. (Hear, hear.)

Mr. Scorgie was serving on the local advisory committee which was carrying out their artificial insemination scheme at Reading. He must confess that in the early stages the scheme seemed rather slow to function: no one was getting more agitated about that than he was, but he believed they should get going fairly soon—probably within a few months.

It seemed to him that there was relatively little to say in addition to what Mr. Scorgie had put forward. He would like to compliment him on what he had put before them: he had not exaggerated the value of artificial insemination nor had he soft pedalled it unduly. The process had advantages and also difficulties, which Mr. Bell had treated very fairly. The scheme to be started at Reading and also at Cambridge had to explore how artificial insemination could be applied in dairy herds in this country and it would be their job, working as a team, to overcome difficulties and to show how they could be overcome: for example, the difficulties of collecting semen from some bulls were very real, especially to a man who had numerous other duties; therefore, he suggested, it was a specialist's job and not a job for a very busy practitioner. The insemination of cows, as opposed to the collection of semen was far less time-absorbing and could be carried out by veterinary surgeons in any part of the country, the technique was very simple. The scheme at Reading would, during the early stages, operate over an area within about 12 miles of Shinfield and they hoped, at a little later stage, to run a scheme that was more widespread. Semen would be collected at Reading by people who specialised in that work and would then be forwarded to veterinary surgeons in various parts of the country. He was very keen on this part of the scheme because it would give an opportunity of testing how a widespread scheme could operate, and how semen could be transported long distances.

Mr. Bell had raised quite a number of points. One was about the selection of bulls, a very important item and a very difficult one; they knew because they were trying to buy a bull at the moment. Nevertheless, they had on their committee several highly successful breeders, who were good judges of cattle of various breeds and whose advice would be of great value. It should be possible to secure bulls of a very high standard—certainly of a much higher standard than many of the bulls that got past the official inspection. The keeping of bulls for an artificial insemination scheme was a war-time economy; because it would reduce the number of bulls necessary, particularly in small herds.

In this country, where we had the best livestock in the world, there was room for this kind of scheme, and he felt sure that all difficulties could be overcome. They hoped to explore every factor; also to enlist the interest of every one concerned: the veterinary surgeon, the farming community and the pedigree breeder. He felt sure that, working as a team, they could produce highly successful results. (Applause.)

Dr. Tom Hare said that he wished to offer one observation upon Dr. Bartlett's very interesting announcement that co-operation between members of the farming community and the veterinary profession was required for the success of his scheme. He understood Dr. Bartlett to be encountering difficulties in those parts of the work which involved co-operation with the veterinary practitioner, but he and Mr. Scorgie must set their brains to work and overcome those difficulties. He was mindful of what Sir Charles Sherrington had shown to be a basic law of biology: that progress does not come from doing the few things very well, but from doing most things adequately. Veterinary private practitioners did not claim to do the few things very well, but, as was clear from the history of the veterinary profession to date, they did most things adequately. In this insemination work there was doubtless going to be the need for a few specialists, but he implored those at the centre to avoid creating a big specialist service. He hoped they would make it a general practitioners' service with the assistance here and there of a specialist. A big specialists' service, within a few years, would become a bureaucracy; and then it would be dead—dead as mutton.

Dr. J. McCunn observed that there were a number of features with reference to artificial insemination which he thought should be considered: they should not enter light-heartedly into large-scale breeding schemes. In this country we were very fond of throwing away our birthright. We were fortunate in that with all breeds of animals, including dogs, we could breed the best in the world.

He would ask the authorities to enter into this artificial insemination business with all due regard to any effect it might have on the pedigree stock industry in all animals, that had been so laboriously built up to its present fine state in this country. If they took horses—and that would do as an example—the welfare of the stud did not depend upon Hyperions: Hyperions were only bred once in a blue moon. If artificial insemination were carried to its proper end, we should only breed from such as were Hyperions. Would there then be any more second- or third-class stallions exported to the Argentine or India? No, they would send a cablegram for a test-tubeful of Hyperion. (Laughter.) No stud could keep going on the possibility of every now and again getting a Hyperion, and they would have to be careful not to cut out all the other useful animals that were bred. Individual studs bred to type. One of the greatest assets of our pedigree stock industry in this country was the fact that everybody had a different opinion in regard to the best type to breed and all of them bred as they thought fit; in the case of the racehorse it was the time test of them or their progeny which proved whether they were any good or not: in the case of the dairy bull it was his progeny which would prove his value. Who was going to choose which animal to breed from? One farmer would breed to a type which he thought to be the best, but 80 per cent. of the other farmers might think differently.

They could not forecast from what had happened in Russia or the Argentine and say that their results would be repeated in this country. Would Russia send over here for so many gross of test-tubes of semen, or should we ship, as he did once, 575 bulls to Russia? One man shipping bulls in that consignment drew a cheque for £5,000; moreover, they were second- and third-class bulls. Was that trade to be abolished? If it were, then those herds and studs which produced those bulls would have to alter their methods, because economically they could never carry on in the hope of producing a bull every five or six years that might sell for £5,000 or £6,000. Therefore, he would beg the authorities to take care to assess properly what effect the widespread practice of artificial insemination would have on the industry in this country, before it went too far and irreparable damage was done.

Mr. G. W. Searles said that he had been listening very closely and it appeared to him that artificial insemination and politics seemed to be rather allied to one another; he would like to say that in his view the capitalist idea should not come into it at all. Dr. McCunn seemed to be supporting the big man and the big breeder, but to his mind artificial insemination was going to be of greatest service to the owner of the six-, eight- or ten-cow dairy. He did not think it mattered at all if some of those big fellows had to change their ideas. Recently it had been the tendency to oust the small man by rules and regulations. The little man should be fostered, and this scheme would help tremendously. (Hear, hear.)

It was almost impossible for the veterinarian in general practice to carry out all that work. He did not know how many of them had had experience of doing work under the N.V.M.A. Scheme. He had a few herds under it and they kept him running about enough, without taking on another scheme; nevertheless, it had a good place in the service of the small man.

Dr. McCunn replied that he would agree that the service would be valuable to the small man. It would also relieve the large owner of the risks he took when he allowed the small man to use his bull.

Mr. Searles asked if there had been any suggestion as to fees to a veterinarian carrying out that work.

Mr. G. A. Tomlin enquired if that subject had entered into the curriculum of the Colleges.

Mr. Scorgie replied that at the Royal Veterinary College artificial insemination was dealt with and demonstrated in the course in Animal Breeding.

Miss B. L. Lock observed that she would like some practical scheme to be put into running order fairly promptly, because she found that there was a great need for it in the small dairy herd. She must say that she only knew of the necessity for it from talking to people with whom she came into contact when signing them up under the Survey Scheme. She could think of at least six small herd owners who were urgently in need of some help from the artificial insemination scheme for two reasons: (1) because they might have herds of Guernseys or Jerseys non-tuberculin tested and the only nearby sire might be in a tuberculin tested herd, and they could not send their cows there; (2) because there were many like one client who had 16 Guernsey cows: twelve of them empty because he had to rely on the services of a bull from a neighbouring herd which was infected with *Br. abortus*—yet from statistics it was shown that it was such small herds which were furnishing half the milk supply of the country and it was not economical for such herds to keep their own bulls. She was sure that an easily worked scheme, if it could be put into operation immediately, would be of great national value and of great help to the producer. (Applause.)

Mr. S. F. J. Hodgman observed that he had nothing to add to the discussion, but he would like to say that he agreed entirely with the last speaker. He thought there was a definite need for such a scheme, and particularly so for the small farmer, as had been stated; he had experienced exactly the same difficulty.

Mr. D. N. Spriggs, speaking in reference to the problem of disease control by artificial insemination, said he would like to ask Mr. Scorgie a question in connection with the transmission of trichomoniasis. He had come into contact with an outbreak of this disease in a large herd, in which four bulls were being used. Two or three of these had been used on infected cows. What would be the risk of passing on the disease by artificial insemination if one of these bulls were employed but using an artificial vagina? A second point he would like to bring up was in connection with abnormal cervices. In his experience, apart from the conditions of acute cervicitis and possibly enlarged cervix in older cows, a not uncommon condition was one in which one got a double cervix, either total or partial. Beyond question it was a teratological condition and was it right to perpetuate a breed of cows showing that condition? He had come across three cases recently and in each instance the animals concerned had had one or more calves, showing that they could breed, and then they had turned.

Mr. T. L. Wright said that a recent speaker had mentioned the great need for the assistance of artificial insemination in small herds. He thought the practitioner had much greater difficulties where there was a number of small herds, than where one large herd existed. If a man found it difficult to inject six animals in one herd of 200, what was going to happen in a district where there were ten small herds, each with ten cows, within a radius of ten miles? It was going to be very difficult to overcome that.

Mr. Scorgie replied that in the case of the large herd to which he referred, the actual work of collection as well as insemination had to be done by the veterinary surgeon employed. Collection of semen was a time-consuming job. In the organised breeding schemes which Miss Lock had in mind, the semen would be sent out in a test tube from the centre, and the practitioner would simply have to put it into the cow.

The Reply

Replying to the remainder of the points raised in the discussion, Mr. Scorgie first thanked Mr. Bell for the very kind remarks he made in opening it. If he could help any of them in this matter he would be only too pleased to do so at any time.

The question of bulls, raised by Mr. Bell, was an important one and he had dealt with it in his address, but had omitted it to-day owing to lack of time. The ultimate test of a good bull was the quality of his progeny, and before a bull could get any progeny, he was five or six years old and over. The majority of dairy bulls were dead long before that and the number of proven bulls in this country could, he believed, be numbered on the fingers of both hands. It seemed, therefore, that the bull would have to be chosen on type and on the milk record of his immediate female ancestors. The high prices recently paid at sales for outstanding animals indicated that breeders must have some accepted standard of judgment as to what constituted a good dairy bull.

With regard to Mr. Sprigg's point about double cervix Mr. Ottaway and himself had just recorded a case of that condition (*Vet. J.* **98**. 134). It occurred in two heifers which had bred quite easily. Here abnormality took the form of a fleshy band across the os uteri. He could not agree with Mr. Spriggs that this type of abnormality was common. With regard to trichomoniasis, there was a definite risk of transmitting the disease by using semen collected from a bull which had previously at any time served infected cows.

With regard to Dr. McCunn's remarks, he thought it was time that somebody did a little "debunking" about livestock of this country. The reputation of Great Britain as an exporting country had been built up, not on the dairy animal, but on beef and dual purpose cattle. He would like to read, in this connection, a quotation from a recent editorial in *The Farmers' Weekly*:—

"We have been breeding dairy cattle for generation after generation, but anyone with honesty and courage must blush to see some of our alleged dairy stock. This country has bred some of the most magnificent milking cattle in the world, deep milkers, good doers and long livers. But the average yield of all our milking stock is hundreds of gallons below any reasonable standard and their average life in the herd, generously counted at three years, is a disgrace."

Continuing, Mr. Scorgie said that he thought, too, that anybody who had critically considered the milk yield of some of our dairy cattle would admit that there was room for blushing. The difference between the good animal and the average animal was a very wide one indeed.

He would point out that any suggestion of shipping stallion semen overseas was impracticable. In the present state of our knowledge it could not be kept fertile for more than six hours after collection. On the question of the export of our best stock bulls, only the other day the President of one of the beef breed cattle societies stated in an address that some of the beef breeds were suffering from the result of the long-continued export of all the best animals out of the country. In the future it might be possible to export the semen from our best bulls and yet retain the animals for service at home.

He thought Miss Lock and Mr. Searles had answered Dr. McCunn's point on the financial aspect of the matter. Artificial insemination schemes did not set out to cater for the large herd-owner; they were primarily intended to help the small man to breed better stock in the future.

Mr. Bell had raised the question of the apparatus. Actually the Russian pattern artificial vagina, to his mind, could with advantage be about three inches shorter. There was sometimes a difficulty in getting animals to serve into the artificial vagina, but he did not think the suggestion made by Mr. Bell of using the type which fitted into the vagina of the cow was practicable because it was extremely difficult to keep it in place. In regard to bulls which refused to serve he had never experienced this with Shorthorn, Friesian and Ayrshire bulls, but he was fully aware that it was a difficulty that might arise.

He would like to thank them again very much for giving him that opportunity of coming there that day.

A Review of the Progress of Artificial Insemination in Kenya

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It is only in the last few years that artificial insemination has been introduced into Kenya but during that time it has made good progress and has become an established method of breeding, particularly in cattle. In this general article, the past, present and future development of artificial insemination in Kenya is briefly reviewed. The adoption of artificial insemination has been of no little value to Kenya and it is probable that under war conditions it will become increasingly important. The results obtained in Kenya have fully justified its application and the experience which has been gained in Kenya may serve as a useful guide to other countries.

At this stage in our knowledge of artificial insemination it is unnecessary to stress its advantages, but brief reference may profitably be made to its uses in a country like Kenya, where the main breeding practice is to grade up both cattle and sheep, by the use of pure-bred sires (see Anderson, 1938). There is little doubt that, so far, the genetic advantages of insemination in cattle have not yet been fully recognised, though this aspect is still obscured by problems of genital disease. In sheep, on the other hand there is a rather better realisation of the genetical possibilities and economy in rams has permitted greater use of rams of better type. Whatever the reasons, however, for the application of artificial insemination, its use in the present system of grading will assist greatly towards attaining uniformity of type and raising production. The choice of sires must be made more carefully, since their widespread use will have a greater effect for better or for worse. It will be particularly necessary to guard against the breeding policy outstripping environmental conditions. The nutritional aspect is largely an economic one and can be overcome. Not so the climatic conditions, but as Daubney (1942) has shown in a discussion on this subject, almost the whole of the areas in Kenya where stock raising is already established, enjoys, as indicated by its mean annual temperature, a climate of the type that is regarded in other countries as eminently suited to the raising of cattle of the European breeds. One or two districts are marginal in respect of atmospheric temperatures and in them the progress of stock raising will have to be carefully watched and, where grade cattle are utilised, those breeds which show the greatest tolerance to warm conditions should be selected.

It is, however, under the present war conditions that the importance of artificial insemination must be stressed. In cattle its value is based on two important factors, (1) the incidence of genital disease, and (2) the practice of importing sires. In sheep only the latter factor need be considered. The extent to which artificial insemination has been adopted in cattle because of the existence of, or for the prevention of, genital disease, is indicated below. Further, it is known, from the practice existing in some herds of running bulls with dry cows (and this usually includes cows difficult to get in calf) that the disease is still fairly prevalent in female stock, though in such herds a satisfactory birth rate has been maintained by the use of artificial insemination. There is little doubt that a reversal to natural service would cause a serious setback to the dairy industry, on account of increased sterility in bulls and cows and a lowering of milk production both now and in the future. Bulls would, with natural service, be exposed to the risk of infection and many would certainly become completely and permanently sterile. The difficulty at present experienced in importing bulls would thus be greatly aggravated. It is also questionable whether, with the large number of stock now being slaughtered, sufficient bulls of any type would be available. In cows there would be a much greater incidence of infection with increased sterility. There would be a longer calving interval with a lowering of milk production and the necessity for using inferior bulls would lead to the lowering of the quality of stock and a decrease in production in future generations.

In addition, however, to the disadvantages of not using artificial insemination, there are certain positive advantages which must be kept in mind. The present system of breeding in cattle is dependent on the importation of pure-bred sires. The number of locally bred bulls is inadequate to meet the demand. It is not at present possible to import the number of bulls required and this shortage will probably become greater as time goes on and bulls pass out of service. Artificial insemination should thus have an increasingly important part to play in making possible the fullest use of such bulls as are available.

Although artificial insemination has been used only in European-owned herds, it may prove of equal or of even greater value with Zebu cattle. Better results should be obtained by the use of selected Zebu bulls than by attempting cross-breeding. The supply of such bulls from Veterinary Training Centres in Kenya should become increasingly available and their intensive use in Native Reserves, together with imported Zebu bulls of Indian origin, by means of artificial insemination, combined with castration of scrub bulls, should be capable of effecting a radical improvement in Native cattle.

It is not possible for artificial insemination to be applied by the Veterinary Department in European-owned herds. The staff is too small and the distances too great for this to be done. In such herds the method is therefore applied by the farmer or his manager, assisted by trained natives. The view was expressed in 1938 that since the method necessarily demanded more of the farmer than does the practice of natural service, it would be interesting to see to what extent and for how long artificial insemination was adopted. It is shown later that the use of artificial insemination in both cattle and sheep has gradually extended, and except in one or two recent instances in which there has been difficulty in obtaining equipment the author is aware of only one herd in which artificial insemination has been discontinued.

In Native Reserves, on the other hand, insemination must be carried out by the Government. A tentative scheme for its application has been drawn up and a considerable number of the staff of the Veterinary Department have been trained in insemination, but no progress has yet been made in this direction. The view was expressed in 1939 that any scheme for the radical improvement of cattle (and also of sheep) in Native Reserves, was practically doomed to failure unless extensive use was made of artificial insemination (Anderson, 1939). It is also the author's opinion that recognition of the possibilities and advantages of artificial insemination would permit considerable progress to be made in animal production in Colonies other than Kenya.

An account of the technique of artificial insemination in cattle and sheep has been made available for the use of farmers and others (Anderson, 1937). Short courses in the technique are given at the Experimental Station and a considerable number of farmers and their Native employees have made use of them. The technique of artificial insemination presents no great difficulties and provided full attention is paid to details, satisfactory results should be and are being obtained. Diluting fluids are supplied by the Experimental Station. The diluent used for bull semen was a glucose-tartaric solution (GTC., Anonymous, 1933). For ram semen the diluents were glucose-phosphate solutions GPS-2 (Milavanov and Selivanova, 1932) and lately GPS-8 (Milavanov, 1933). For storage of bull semen excellent results have been obtained with the egg yolk-phosphate (Phillips, 1939) and egg yolk-citrate diluents (Salisbury, Fuller and Willet, 1941). The experimental work on artificial insemination has been presented and discussed in several publications—general (Anderson, 1938; 1939); cattle (Anderson, 1941); sheep (Anderson, 1937; 1941).

CATTLE

Artificial insemination was first started in Kenya in 1935 and within a short time a relatively large number of cattle were being bred in this way, the main reason for this being the prevalence of a serious form of genital disease. A questionnaire sent out recently elicited the following information, but it is possible that the data are not quite complete.

At the end of 1941 there were 36 farms in Kenya known to be practising artificial insemination. The total number of female stock of breeding age on these farms was 15,003 and the total number of bulls was 158. In the latest census of cattle on European farms, made in 1936, there were 64,586 grade, cross-bred, and pure-bred cows and heifers over three years of age and 2,288 grade and pure-bred bulls. The figures for 15,003 cows and 158 bulls used for artificial insemination therefore represent 23·2 per cent. and 6·9 per cent. of the total cow and bull population. The bulls used for artificial insemination consisted of 144 pure-breds, ten grades and four Zebu bulls. The pure-bred bulls used for artificial insemination therefore represent 26·1 per cent. of the total pure-bred bull population of 552 in 1936.

The development of artificial insemination since 1936 is shown in Fig. 1, in which it is seen that the increase in the number of farms using artificial insemination and the total number of adult female stock being inseminated have both increased steadily since 1937, though in 1941 there was a decrease in the number of new farms and cows.

The average number of cows inseminated per bull has changed but little in each year. In 1937 there was an average of 89·8 cows per bull; in 1938, 94·6 cows per bull; in 1939, 90·0 cows; in 1940, 97·2 cows and in 1941, 94·9 cows. On the basis of the figures on the 1936 census, there was a ratio of 28·2 cows per bull when natural service was the method of breeding. While there has thus been an increase of about three and a half times in the number of cows bred per bull, these figures show that there is room for a still further increase in this respect. There are several reasons why a larger number of cows have not been bred per bull. On most farms the bulls that were used for natural service were retained for artificial insemination and this number was only gradually reduced. Also, some farms make a practice of running a number of bulls with the

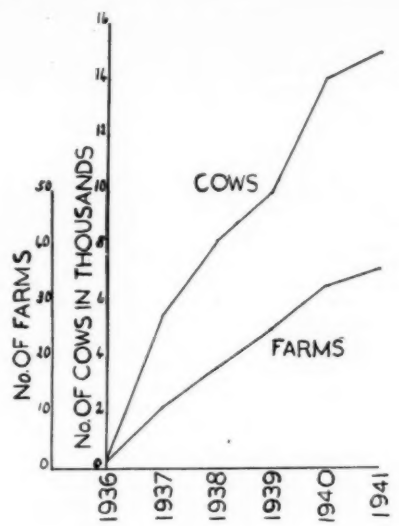

Fig. 1.

dry herd to pick up cows that return. One farm of 660 female breeding stock, for example, does not use insemination entirely. Bulls are run with the dry herd and heifers for first calving (this farm has 24 grade and Zebu bulls—this number of bulls is not included in the above bull figures as they are apparently used for natural service) and milk cows are inseminated only when near the homestead.

Three farms were well above the average in the average number of cows inseminated per bull—(1) 516 cows and three bulls, average 172 cows per bull, (2) 466 cows and three bulls, average 155 cows and (3) 258 cows and two bulls, average 129 cows. On the other hand there were three farms with 50, 54 and 80 cows each respectively, each using two bulls.

There is at present little transport of semen between farms, but with the better methods of storage now available, it is likely that this procedure will increase. One farm of about 50 cows has for the last few years successfully used semen from another farm 20 miles away. On another farm with 366 cows, three bulls have been used for the home stock and a further 150 cows on a neighbour's farm and it is intended to inseminate a further 200 head on a second neighbour's farm with the same three bulls. When in operation this use of three bulls for 716 cows, *i.e.*, 239 cows per bull, will represent the maximum use achieved with bulls in Kenya. A third farm of 50 cows was also providing semen for an additional 100 cows on a neighbour's farm.

No detailed figures are available for the results of insemination on these farms, but it may safely be inferred from the continuance of use of artificial insemination on farms over a period of five years and its extension to other farms, that satisfactory results have been and are being obtained. It is known to the author from personal experience of several herds that results equally satisfactory, and in some cases better than those of natural service have been obtained. In cows inseminated experimentally (Anderson, 1941) on an average 1·88 inseminations were required per conception.

The main reason for the use of artificial insemination in cattle was the prevalence of genital disease (Anderson, 1941) and there is little doubt that the prompt and widespread adoption of insemination has saved the dairy industry serious loss. Of the 36 farms using artificial insemination at the end of 1941, 24 farms, involving 11,910 cows had adopted insemination because of the existence of infection in these herds. Eleven farms, involving 3,093 cows (20·6 per cent. of total) and 40 bulls (25·3 per cent. of total) adopted insemination for reasons of economy of bulls (five farms also gave as an additional reason prevention of infection). Therefore in only one-third of the farms involving about one-third of the cows and one-quarter of the bulls was artificial insemination adopted for reasons other than genital disease.

In Kenya there are many herds numbering hundreds of cows for which a large number of bulls were required. Most of the larger farms have already adopted insemination and effected a considerable economy in the number of bulls as well as an increase in the effective service period. At present there are more bulls in use than is actually required, but it is necessary to remember that bulls (on account of illness or other ill-defined causes) cannot be relied upon consistently to produce semen of good quality and that it is essential to have a bull or two in reserve. There is also the difficulty of replacing bulls at short notice in Kenya to be considered.

The limit to the use of artificial insemination in cattle has hitherto been on small rather than on large farms, as with a small number of cows much the same number of bulls was required for insemination as for natural service, excluding the question of disease. The use of stored semen, which is now an eminently practicable proposition, should, however, extend its use to smaller farms.

There is little doubt that considerable progress in cattle breeding in Kenya can be achieved by the adoption of artificial insemination on a communal basis. A scheme based on extensive knowledge of artificial insemination in Kenya, together with available knowledge of its application on a communal basis in other countries, has recently been evolved (Anderson, 1942). Insemination on large farms in Kenya presents many similarities to but also several differences from those conditions encountered when artificial insemination is being operated communally in a district. The presence of a large number of cows on the one farm under the same management undoubtedly makes the application of artificial insemination easier than it would be among a community of independent farmers. Nevertheless, the difficulties of applying artificial insemination communally in a district in Kenya are largely those of organisation and can therefore be overcome.

Under the auspices of the Director of Veterinary Services, the Trans Nzoia Community Bull Scheme, based on the use of artificial insemination, was formed in September, 1941. This is the first scheme of its kind in Kenya, and the author is not aware of another one in the Colonies or even in the British Empire. The Director of Veterinary Services has expressed the view that the adoption of the Community Bull Scheme would, after the Cattle Cleansing Ordinance, be the most important single step in planning development of the dairy industry in this district.

In this scheme a number of farmers have subscribed £10 each for capital expenditure and Government has subscribed pound for pound with the farmers. This sum is to be devoted to the cost of bulls, buildings and equipment. In the first year it was suggested that 1s. should be paid for each insemination and there would be a small charge to cover motor cycle expenses for a Native inseminator It is proposed to use bulls of one of the Channel Island breeds and the Indian Sahiwal breed. This service will be under the control of the local veterinary officer and in addition to artificial insemination, will include control of diseases of the reproductive system. All herds participating in the scheme will be regularly inspected with a view to early diagnosis of genital disease. Herds infected with contagious vaginitis and contagious abortion will be under close supervision and all the resources of modern laboratory technique will be employed in the control of these infections. In addition, a survey will be made of the incidence of mastitis and members will be encouraged to record their herds. It is quite probable that the success of this scheme will encourage the development of others.

The Committee of the East African Stud Book have drawn up regulations similar to those of certain breed societies in Britain for registration of progeny born as the result of artificial insemination.

Sheep

In the seasons 1936-37 and 1937-38, artificial insemination was used on one farm on 716 and 1,400 ewes and 76 per cent. and 65 per cent. of the ewes lambed. This farm has not to the author's knowledge continued with artificial insemination. In 1937-38 the artificial insemination seasons were rather prolonged and many ewes did not hold until they were run on young growth of wheat stubble.

In 1938-41 inclusive two farms (G and S) under the same management used artificial insemination. The total figures for 1938, 1939, 1940 and 1941 were: ewes 1,340, 3,669, 3,042, 2,875 respectively and the birth rate was 61·9, 75·8, 67·7, 72·3 per cent. respectively. The results on the two farms (G and S) were very similar except that in 1941 the birth rate at farm S was 81 per cent. Insemination was carried out for about seven weeks, after which rams were run with the ewes. On an average 3 to 10 per cent. of lambs were born from natural service in different years. The figures for insemination and natural service may not be quite accurate but the birth rate for the combined practice averaged 66·2, 86·6, 70·4 and 74·9 per cent. in the four years. In the Experimental Station flock a total of 2,540 ewes were inseminated in the period 1935-41 and the average birth rate was 64 per cent. In different years the lambing varied from 47 to 79 per cent. This figure is somewhat lower than it might have been because of certain experimental procedures and lack of knowledge of the optimum season for breeding. In 1941 another farm used insemination on 490 ewes, 80 per cent. of which lambed, producing 92 per cent. lambs. The total number of ewes inseminated by the farmer himself has thus increased from 1,340 in 1938 to 3,375 in 1941, and the average lambing for this period was 76 per cent.

From natural service a 75 per cent. lambing is considered satisfactory in Merino sheep in Kenya. There is, however, considerable variation from year to year. Several experiments have been made

at Naivasha to obtain reliable figures for fertility in this type of sheep. Seventy-four per cent. conceptions has been obtained when the rams were run with the ewes; 70 per cent. of conceptions when the ewes received a single service and 57 per cent. when the ewes received two services at six hours interval. On one farm, hand service, together with running the ewes with the rams for the last ten days of the breeding period, gave 67 per cent. lambing. On another farm, in 1941, a comparison was made between (1) insemination only of 490 ewes, (2) hand service and insemination of 2,480 ewes (the ewes were hand served in the morning and if on heat in evening and following morning were inseminated) and (3) natural service of 500 ewes. The percentage of lambs born in the three groups was 92, 81 and 82 respectively. In the first group—insemination only—80 per cent. of the ewes lambed. The results on the whole from artificial insemination thus compare favourably with those from natural service.

In the Experimental Station flock of high grade Merinos, no attempt has been made to inseminate the maximum number of ewes with one ram, but the number of rams actually used was considerably less than when ordinary service was practised. This flock of 600 ewes required 18 rams for ordinary service. In the period 1935 to 1939 an average of three rams were used per breeding season. In 1940 and 1941 the same ram sufficed for insemination of about 500 ewes in each year. The number of ewes inseminated on an average per ram and the number of lambs born to one ram as the result of artificial insemination showed a considerable increase over the figures for natural service. In the period 1935 to 1939 an average of 348 ewes were inseminated by one ram and an average of 191 lambs were born to one ram. One ram in 1937 sired 411 lambs. On one farm in 1938 one pure-bred Australian Merino ram was used to inseminate 1,340 ewes, of which 887 (62 per cent.) lambed. This number of lambs, so far, is the largest sired by one ram in Kenya. On farms G and S three rams have latterly been kept for 1,500 ewes, but two have usually sufficed. On these farms the insemination season usually lasted seven weeks and the majority of ewes were inseminated twice per heat period. A maximum dilution of $\times 8$ was used.

At Naivasha the main factor in obtaining a satisfactory lambing is the season of the year at which it is practised. In general, the best results have been obtained in the early months of the year, when the incidence of oestrus is highest and the cycle shortest.

The large-scale application of artificial insemination to sheep breeding in Kenya would undoubtedly benefit both the European farmer and the Native. In Kenya 3 per cent. is the usual number of rams in European-owned flocks. In the larger flocks numbering several thousands of ewes it is usually impossible to provide this number of pure-bred rams and consequently grade rams have to be used to some extent. Since all the pure-bred rams used are imported, the use of artificial insemination should be especially valuable in war-time. As regards Native sheep there is unlimited scope for the use of rams of mutton and wool types, in those parts of Kenya suited to the particular type of sheep. The possibilities of the more widespread application of artificial insemination to sheep in Kenya are indicated by the results already obtained.

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Weekly Wisdom

In the study of any branch of science, an acquaintance with the historical development of knowledge is an important element in a clear understanding of our present conceptions. To the student of bacteriology such a basis is essential. It is almost true to say that the clue to the present position of bacteriology is the curious fact that there have been no bacteriologists.—Topley & Wilson's "The Principles of Bacteriology and Immunity."

* * * * *

At a sale of bloodstock from the late Lord Glanely's stud at Newmarket recently a brood mare in foal to Hyperion was sold at the record price of 17,000 guineas.

CLINICAL COMMUNICATIONS

Multiple Abscesses in a Mare treated with Staphylococcus Toxoid

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Subject.—Eight-year-old Shire mare.

History.—For about one week a succession of abscesses had appeared on the near hind leg and had failed to respond to antiseptic dressings.

Examination.—The leg was much swollen and four deeply seated abscesses could easily be detected apparently along the line of lymphatic vessels. One abscess above the hock was pocketing and causing much sloughing. The lameness was pronounced and acute. The mare's temperature was 104·5° and her appetite very poor.

Diagnosis.—A sample of pus was forwarded to Cardiff, and Capt. Bissett reported the presence of *staphylococcus aureus* and a few *B. coli* which he considered of no significance.

Treatment.—7.9.42.—The abscesses were opened and curetted and, where necessary, drainage was obtained. Hot fomentations were applied and sulphanilamide given in adequate doses.

10.9.42.—There was no improvement in the local or general condition and, the laboratory report being available, 10 c.c. of staphylococcus toxoid was injected intramuscularly.

12.9.42.—The patient was much brighter and the temperature had fallen to 102·5°. The swelling of the leg was reduced; 15 c.c. of toxoid was injected.

14.9.42.—The systemic disturbance had subsided, the temperature now being 101·5°. The leg swelling was markedly reduced and the abscesses were healing rapidly; 20 c.c. of toxin was injected.

Thereafter progress towards complete recovery was rapid but a local abscess developed at the site of the last injection. It was opened and healed quickly.

Remarks.—The response to treatment with staphylococcus toxoid was sufficiently dramatic to justify the belief that in this case it acted as a specific.

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Cancer in a Budgerigar

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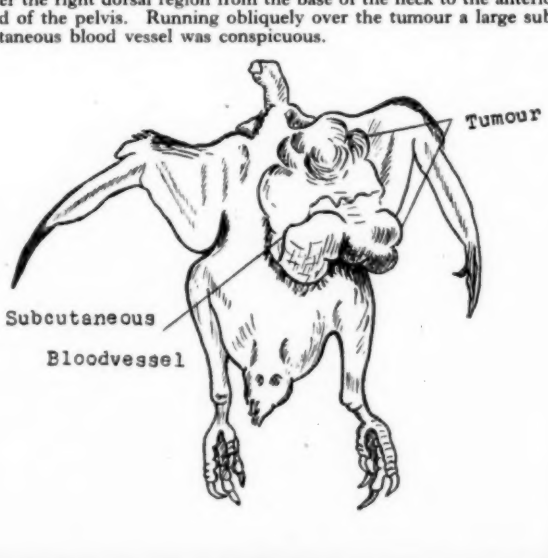
The subject was a young cock budgerigar (*Melopsittacus undulatus*) which was brought in with a history of having damaged its wing. It was found to be incapable of effective flight and on being released it fluttered to the ground.

On examination a very extensive swelling was discovered involving the right wing and right dorsal region. It was decided that the swelling was neoplastic and that no good could come of any attempted treatment, so the patient was destroyed.

The tumour was irregularly lobed, three main masses being distinguishable, and was of firm consistence. Some idea of its extent and shape may be obtained from the sketch. It extended over the right humeral region, pushing this wing out from the body so that it could not occupy a natural position. In addition, it extended over the right dorsal region from the base of the neck to the anterior end of the pelvis. Running obliquely over the tumour a large subcutaneous blood vessel was conspicuous.



Dr. E. G. White, of the Royal Veterinary College, kindly made sections of the tumour and described it as a spindle-celled sarcoma which was infiltrating the pectoral muscles.

I found the whole neoplasm weighed 99 grains. Unfortunately the head of the bird was missing when I made the calculation but, without the head and feathers, the total body weight was 419 grains. Thus the tumour was 23·6 per cent. of the body weight (excluding the head).

Spindle-celled sarcomata do not usually give rise to metastases as readily as the round-celled variety, but the great size of this one and the probable length of time it had been growing suggested that metastases might be found. Sarcomata spread by the blood stream and the region which the growth occupied would be drained by the right brachial, subclavian and pectoral veins, which discharge their blood into the right precaval vein, which in turn opens into the right auricle. The first place one would expect to find metastatic growths would therefore be the lungs, but these appeared perfectly healthy, as did all the other internal organs.

I think this case is of interest as it shows to what an enormous size a malignant neoplasm can grow without any evident metastasis.

ABSTRACT

[STUDIES IN FERTILITY IN SHEEP: SEMINAL CHANGES AFFECTING FERTILITY IN RAMS. Gunn, R. M. C., Sanders, R. N., and Granger, W. (1942.) *Bull. No.* 148. *Coun. Sci and Indust. Res., Australia.* (For shorter account, see also *Aust. vet. J.* **18**. 3-15.)]

The work described in this bulletin is part of a wider investigation directed to solving the problem of low fertility in Australian flocks. The aspect here dealt with by the authors is a comprehensive study of the factors which produce degenerative changes in the semen of the ram.

Seasonal Changes.—Attention was first directed to the effect of climatic conditions on the production of abnormal variations in ram semen. Preliminary observations in some of the hotter parts of New South Wales had indicated that abnormal semen characters were more frequently met with in summer than in winter. In order to determine whether these degenerative changes in semen were solely or mainly due to the effects of heat, ten rams known to produce normal semen were placed in an insulated chamber and maintained for varying periods under controlled artificial temperature and humidity conditions closely resembling the natural atmospheric conditions prevailing in summer in Western N.S.W., where high shade temperatures of over 100° F. and minimal daily temperatures of 80° F. are common. Under the experimental conditions, either a short continuous period of only a few days or a short daily exposure on a greater number of days was sufficient to cause extreme seminal degeneration. The amount of seminal degeneration was found to vary according to the degree of heat and to the duration of exposure to which the rams were submitted.

Having demonstrated experimentally that artificial hot atmospheric conditions could cause seminal degeneration in rams, the authors proceeded to investigate the seasonal changes that occurred in clinically normal rams' semen under natural conditions. The data presented show that seasonal variations do occur in rams' semen, varying from slight changes (best indicated by motility, longevity and sperm numbers) in the early stages or in cool districts to well marked degeneration, including considerable morphological changes in the later stages in hotter districts. The degree of degeneration is variable in different individuals, but in hot districts may be so marked that normal spermatozoa are entirely absent or present only in very small numbers. This seasonal degeneration is followed by a peculiar recovery stage and finally by optimal semen production, the stage usually looked upon as normal. Though a number of causes may operate in the production of seminal degeneration, including deficient nutrition, a consideration of all the relevant data leads the authors to the conclusion that the main cause of the seasonal changes observed is high atmospheric temperature. This remarkable susceptibility of the ram to heat is doubtless related to his very poor ability to lose heat by sweating. The value of adequate shade in the prevention of seminal degeneration is borne out by the observations of the authors themselves and by evidence from experienced sheepmen, who state that fertility of sheep kept in shadeless hot districts or paddocks is considerably lower than in those kept in well shaded, even though hotter areas.

The results of the survey made by the authors and their experimental data indicate that the adverse effects of heat on semen production would be noticeable in districts in which daily recurrent maximum temperatures were for long spells above 90° F. with occasional readings of 100° F., and that such effects would be well marked in districts subject to daily recurrent temperatures for long spells above 100° F.

Seminal Degeneration Caused by Fever.—As blow-fly strike in sheep is often accompanied by a rise in body temperature, and as the semen of fly-struck rams was found not to conform to the standard of the average rams, the authors investigated the effect of artificial blow-fly strike on spermatogenesis in Merino rams. It was found that blow-fly strikes produced degrees of seminal degeneration varying from mild to very marked according to the depth, extent and duration of the strike. More marked seminal degeneration followed strikes on the scrotum than elsewhere.

Seminal Degeneration Caused by Arsenic.—Carefully controlled experiments showed that, after dipping in arsenical dips (containing even less than the usually recommended 0·2 per cent. of As_2O_3) rams may absorb through the intact skin comparatively large amounts of arsenic, sufficient to cause seminal degeneration. The authors consider that it is inadvisable to use arsenical preparations, which may contain as much as 0·9 per cent. As_2O_3, for the treatment of fly-strike in rams. Tests made on dipping rams with non-arsenical fluid dips showed no harmful effects on spermatogenesis.

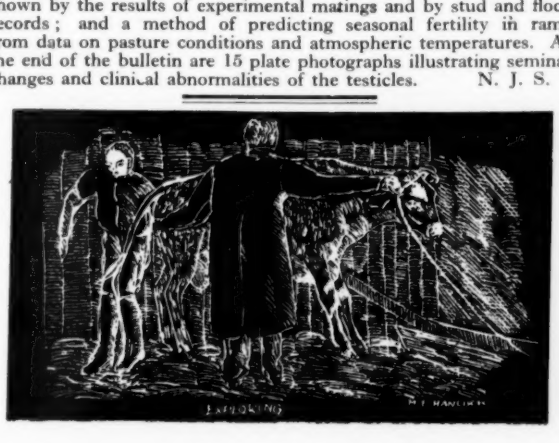
Other Causes of Seminal Degeneration.—The authors state that they have frequently observed seminal degeneration in rams suffering from or recently recovered from the following disease conditions: pneumonia, "big-head," abscesses, extensive infected wounds, nasal infection associated with polypi, foot-rot, etc. In the case of foot-rot, well marked seminal degeneration occurred, though the rams showed no undue rise in temperature. In the more serious clinical conditions no normal spermatozoa were sometimes to be found in the ejaculate and normal spermatogenesis did not recommence until about two months after the animal had regained normal health.

Seminal Degeneration Caused by Deficient Nutrition.—During drought periods the authors have observed varying degrees of seminal degeneration in apparently normal rams at times of the year not corresponding to seasonal heat. They, therefore, investigated the effects on spermatogenesis in rams of feeding various deficient diets. These included old leached grass hay, straw chaff, broken linseed cake and cane sugar; control rams were fed on wheat chaff, lucerne hay, oats, linseed cake and bran. The semen of the rams kept on the control diet remained normal throughout. Degeneration of the semen of all rams kept on the deficient diets occurred within 2½ to 4½ months, even when their body weights remained relatively constant. In those in which considerable losses in body weight occurred seminal degeneration was the more rapid. Night blindness occurred in all the rams with degenerated semen; in most cases it was observed shortly before signs of seminal degeneration became evident. Degeneration was prevented, improved or cured by the use of supplements of carrots, green grass or liver meal in molasses, or by a vitamin concentrate, containing mainly vitamin A. No indication of vitamin C deficiency in rams with seminal degeneration was found. The authors conclude that lack of green food with its associated vitamin A deficiency was the cause of the observed degenerative changes in rams' semen at times of the year other than those of intense heat.

Clinical Abnormalities with Genitalia.—In an examination of over 9,000 rams the authors found the frequency of the more common abnormalities to be as follows:—

Hypoplasia or atrophy of the testes, 3·4 per cent.; epididymitis and spermatocele, 5·5 per cent.; varicocele, 1·6 per cent.; cryptorchidism (unilateral), 0·5 per cent.; and inguinal hernia, 0·2 per cent.

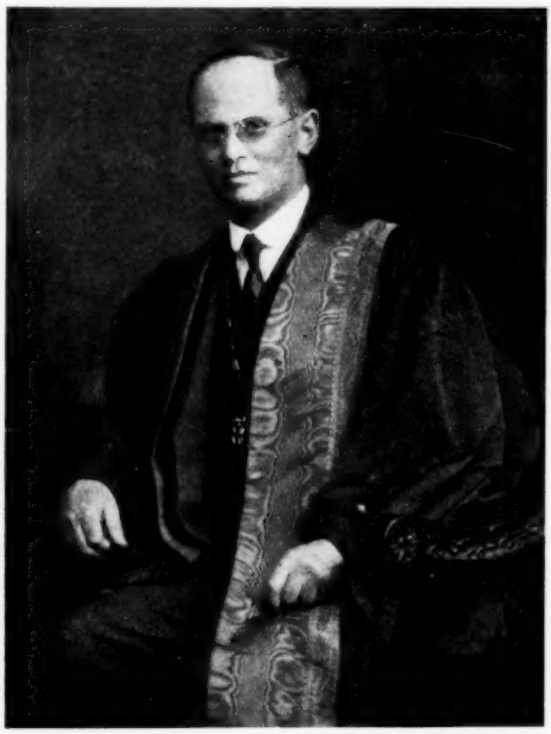
Other items dealt with in the bulletin are: The distinctive features of semen exhibiting incipient degeneration and recovery; the relationship of the seminal picture to the fertilising power of semen as shown by the results of experimental matings and by stud and flock records; and a method of predicting seasonal fertility in rams from data on pasture conditions and atmospheric temperatures. At the end of the bulletin are 15 plate photographs illustrating seminal changes and clinical abnormalities of the testicles. N. J. S.



MEMOIR

Professor J. F. Craig, M.A., F.R.C.V.S., M.R.I.A.

It was with the deepest regret that we received the intimation of the death of Professor Craig at Rhyl on Wednesday, January 20th, 1943, after a very short illness, at the age of 64 years. It came as a profound shock to his friends and members of his profession, and especially to those colleagues of the Council of the Royal College of Veterinary Surgeons who saw him at the Council meeting at York less than a week before his death, when he had taken an active part in the deliberations with his accustomed vigour and sound judgment.



[*Lafayette, Ltd.*

James Ferguson Craig, generally known as "Jim" and even "Jamie" or "Hamish" to his more intimate friends and for some unknown reason for many years past to his students by the affectionate name of "Joey Craig," was a Glaswegian and proud of it, a typical "canny Scot." He showed early ability and gained a County Bursary at his local school and proceeded to the University of Glasgow, where he took his degree as Master of Arts. He commenced his veterinary studies at the Glasgow Veterinary College in 1898. After taking his first two years there he transferred to the Royal Veterinary College (London) and gained his membership of the Royal College of Veterinary Surgeons in 1902. During his college career he took medals (usually the 1st place) in nearly every subject in the curriculum as well as the coveted Centenary Prize in each of his two years at the London College. After graduating he was appointed Tutor at the R.V.C. and was evidently destined for greater heights. In 1903 he went to Dublin as Professor of Anatomy and Histology at the Royal Veterinary College of Ireland and later he succeeded Professor Wooldridge in the chair of Veterinary Medicine and Parasitology on the latter's transfer to the Royal Veterinary College in London in 1908. On the death of Professor Mettam in 1919, Craig became the second Principal of the College, an office he retained until he was appointed to succeed the late Professor S. H. Gaiger in the William Prescott chair of the Care of Animals—Causation and Prevention of Disease, in the University of Liverpool and later to become Director of Veterinary Studies in that University—posts which he occupied up to the time of his death. While in Dublin his ability as a scientist was recognised by his election as a Member of the Royal Irish Academy, a much coveted honour. The experiences in these various offices combined to produce an almost unique personality, for he was an acknowledged expert anatomist, histologist, pathologist and clinician.

Veterinary literature has been enriched by his many scientific and clinical contributions which are far too numerous to indicate here, and were published for the most part in *The Journal of Comparative Pathology and Therapeutics*, *The Veterinary Journal* and *The Veterinary Record*. Others include "The Use of Drugs in the Treatment of Disease caused by Nematode Worms" (International Veterinary Congress, 1914); "Blackhead in Turkeys" (Fourth World's Poultry Congress, 1930); "Plant Poisoning" (with Kehoe—N.V.M.A. Congress, Dublin, 1926). He contributed several articles in Wallis Hoare's "Veterinary Medicine" and wrote the chapters on (*a*) "Mange Mites and Mange" and (*b*) "Blood-sucking Flies" in Wooldridge's "Encyclopedia of Veterinary Medicine and Surgery." He edited and revised several editions of Fleming's "Veterinary Obstetrics."

His services were often sought by educational bodies as external examiner for degrees and diplomas, such as the Universities of London, Liverpool, Belfast, and the Royal College of Science, Ireland.

Despite his many other activities, Craig found time to take a very active part in the government of the veterinary profession. He was a member of the Council of the Royal College of Veterinary Surgeons from 1919 to 1935, and again from 1937 onwards, and was President, 1929-30, during the delicate negotiations between the Royal College and the new Government of the Irish Free State (now Eire), and the success of those negotiations owed much to the tactful activities of Professor Craig. In 1931 the Council awarded him the John Henry Steel Memorial Medal, voted "as a reward for scientific or literary work of merit connected with the profession," while in 1936 the Council elected him to the Fellowship of the R.C.V.S. "in recognition of his eminent services to veterinary science."

Professor Craig was a very keen supporter of the activities of the National Veterinary Medical Association of Great Britain and Ireland, both as a member of its Council and of numerous committees. He was President of the Association in 1934-35 and presided at that very successful Congress held in Belfast in 1935.

Despite the numerous honours conferred upon him, Professor Craig was one of the most modest of men, always readily accessible to students, colleagues and practitioners alike, and always ready and anxious to be of service to them in any way possible, and to give advice which was so often sought from him. Nothing was too much trouble for him and his help in all directions proved a boon to the practitioners in Ireland. He was not very long at Liverpool, but, as was stated at a recent meeting of the Council of the N.V.M.A., the Welsh practitioners (for Liverpool University serves North Wales to a remarkable degree) had already come to regard Professor Craig as their professional godfather in recent years.

Of his more intimate personal qualities so much could be said by those of us who knew him best. His sincerity and his never failing good humour made him a companion to cultivate. He possessed the faculty of making one feel that you were just the one person he was anxious to see, and he always met you with his infectious smile and (yes, it must be said, for this was Craig) with his inevitable chronic cigarette-throat cough. Craig had few relaxations, but he entered wholeheartedly into them when he found time. They included golf, dancing, an occasional hand at bridge and—the cigarette. Yes! we shall miss Craig and we shall be sad, but it may truly be said that the world was the better for his "passing this way."

Our sympathies go out to his widow, who encouraged him in his work and never grudged him the time he felt necessary to devote to it. Many will remember Mrs. Craig and the charm with which she acted as hostess at the various professional meetings—particularly the Congress in Belfast. And to his only son, Dr. Kenneth Craig—now serving with His Majesty's Forces "somewhere in the East."

This year Holland's cattle herds will be halved by German requisitioning, declare Dutch experts. Herds will then consist of 800,000 milch cows and 500,000 calves, heifers and bulls. Value of cattle requisitioned by the Germans will by then be £40,000. It will take many years after the war to raise cattle to their old numbers.—*Reuter.*

The Late Colonel R. J. Stordy, C.B.E., D.S.O., M.R.C.V.S.

A Further Personal Tribute

We have received the following additional personal tribute to the late Colonel Stordy, whose death was recorded in our issue of January 16th.

Mr. H. W. Steele-Bodger, M.R.C.V.S., of Tamworth, Staffs, writes:—

So my old friend Stordy—'the Colonel' to so many—has passed on and with his passing a chapter in veterinary history is ended, a chapter full of adventure, of initiative, of determination and of indomitable optimism and courage. The outstanding character in that chapter was Robert Stordy. Many of his colleagues have told me of his work during the last war and in the years preceding it. Pieced together, they would make a grand story.

It is a matter of supreme regret to me that I never met Stordy until just before the outbreak of this war, as I feel I have been cheated of many years of a friendship which I soon learned to value highly. We spent very many days—and nights—together during two strenuous and troublous years and I found him a staunch and loyal friend, a generous host and an entertaining guest. And what a vivid raconteur—an evening with Stordy passed all too quickly and made one forget the blitz, the petty jealousies and the financial worries with which we were then surrounded.

Three times in his life Stordy was denied the full fruits of the success to which his professional and his organising ability entitled him. The first time in East Africa, the second in Peru and the third and final disappointment was the difficulties met with in his efforts on behalf of N.A.R.P.A.C. It is paradoxical to reflect that this should have been the experience of one who had done so much to alleviate animal suffering all over the world. With his passing the animal kingdom has lost a crusader.

Possessed of a commanding presence and a fine personality, Stordy upheld the dignity of the profession on all occasions. His own personal courage was shared by a very gracious lady whose charm captivated all—and whose complexion, in spite of years spent in torrid climes, is the envy of many of the fair sex 50 years her junior. Mrs. Stordy stayed on with the Colonel at the height of the blitz until their hotel was bombed and she was pinned against her bedroom door by a window frame. After that the Colonel was twice bombed out of his club, but still he carried on—cheerfully.

I well remember his story of one of his clubmates' discomfiture! During the height of a bad night, this individual had sought sanctuary under a billiard table; being very stout only his head and chest were under cover. During a lull a third member thus addressed him: "I would have you know, sir, that the most vulnerable part of your anatomy is still exposed and in danger!"

One remembers also the Colonel's reply to a lady who rang him up and complained that her nearest N.A.R.P.A.C. post was a quarter of a mile away. "Madam," he replied, "I congratulate you, you are indeed fortunate as veterinary surgeons do not grow on trees."

One lady did set him a teaser, however: she wrote saying that she had followed the advice to put on her gas mask so that her dog would get used to seeing her in it, but that the dog took one look, bolted, and had not been seen since. Could the Colonel assist her to trace the dog?"

The story above all others which impressed me concerned an experience in Peru. After many months of search for a suitable spot in which to live, the Colonel decided to build a home close beside a centuries-old mimosa tree—the only tree for miles around—so that its shade would shelter the living rooms. At the housewarming, Stordy gave his head man instructions to cut down a dead stump beside the mimosa. During lunch there was a terrific crash. Misunderstanding his instructions, the man had felled the mimosa tree. One can well believe the Colonel when he said that he never realised before of how many languages he was master! I can never recall that story—so final and irrevocable—without sweating in the palms of my hands.

Stordy's memory for names and places was uncanny. It was the year after he qualified that he was assistant to Watkins at 10, Bore Street, Lichfield, and he talked of cases seen then, of people he met, and when on our way to Lichfield one day he pointed out to me houses and farms which he had visited. He described in detail the house in Bore Street before we arrived there. He asked after one family with whom he had been friendly and who still lived in Lichfield; he painted a vivid verbal picture of the daughter and was surprised to hear that she had aged—after 46 years! That, I think, was typical of him—he never felt his own years and could not understand how others grew old.

Robert John Stordy—a grand campaigner with much for us to admire, much for us to strive to emulate. He was ever jealous for his profession; he left it better than he found it, and we, his friends and colleagues, are the richer for having known him.

QUESTIONS IN PARLIAMENT

Veterinary Investigation Officers (Powers)

Mr. David Adams asked the Minister of Agriculture whether veterinary investigation officers, now being appointed in many parts of the country, possess executive authority to ensure that farmers shall adopt methods to improve the conditions and preserve the lives of their stock and thus save annually large numbers of animals whose potential value in meat, wool, etc., is being lost to the country?

Mr. Hudson: Veterinary investigation officers do not possess such authority. Their duties are to conduct investigations and advisory work in their respective areas under my Department's scheme for the provision of technical advice to farmers.

Mr. Adams: Is the Minister aware that this voluntary method has been in operation during the last 100 years without much success, and does he not consider that some compulsion is essential to-day to save large quantities of stock which are dying?

Mr. Hudson: I have not been Minister of Agriculture for 100 years.

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Hill Sheep Farming (Committee's Report)

Major McCallum asked the Secretary of State for Scotland (1) when he expects to receive the report of the Committee he appointed last year, under the chairmanship of Lord Balfour of Burleigh, to enquire into the hill sheep farming industry in Scotland; and whether the report will be made available to hon. Members at an early date;

(2) Whether he is aware that, while the hill sheep farmers of the Highlands appreciate the steps taken by the Government to help them over their difficulties by financial subsidies such as those granted each year since 1940, they feel this short-term policy of subsidies should be replaced by a long-term policy which would enable farmers to plan ahead with confidence; and whether he will take action on these lines to guarantee them a reasonable market for their produce?

Mr. Chapman: My right hon. Friend understands that the Hill Sheep Committee have practically completed the hearing of evidence, but that it may be some time before they are in a position to report. Until he has received their recommendations he cannot make any statement as to the long-term measures which may be practicable and desirable to improve the position of hill sheep farming in Scotland. But my right hon. Friend fully agrees with my hon. and gallant Friend on the desirability of a long-term policy.

Major McCullum: Is the Minister aware that the issue of this report is awaited in the Highlands of Scotland even more keenly than elsewhere, and may I ask that it should not be too long delayed?

Mr. Chapman: Yes, sir. My right hon. Friend would welcome this report at the earliest possible moment.

Mr. Snadden: Is it not a fact that the Committee is considering only post-war problems?

Mr. Chapman: The remit of Lord Balfour of Burleigh's Committee asked in effect for an indication of the basis on which a long-term policy might be framed.

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Marginal Land Cultivation (Scotland) (Committee's Report)

Mr. Snadden asked the Secretary of State for Scotland whether he will make available to Members of Parliament the Report of the Committee set up by him to investigate the question of marginal land cultivation?

The Joint Under-Secretary of State for Scotland (Mr. Allan Chapman): The Report in question was presented by a Committee presided over by a Departmental official and was prepared for a Cabinet Committee. My right hon. Friend does not, therefore, propose its publication.

Mr. Snadden: Is the hon. Gentleman not aware that there is very great interest in this question, and will it not raise suspicions that there is something that the Government wish to hide if the whole Report is not made available?

Mr. Chapman: I do not think that is the case, but I will bring my hon. Friend's observations to the notice of my right hon. Friend.

Mr. Snadden: Can the hon. Member say whether the extreme powers given to county committees were recommended in the Report?

Mr. Chapman: That is another question.

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Post-War Reconstruction

Sir Irving Albery asked the Minister without Portfolio whether any post-war short-term policy is being planned to deal with demobilisation, employment, housing and finance; and what Ministers, commissions or committees are charged with these urgent tasks?

Sir W. Jowitt: All these matters are engaging the close attention of the Ministers directly responsible under the general co-ordination of the Ministerial Committee on Reconstruction Problems, of which I am Chairman. In the statement which I made to the House on December 1st I described the machinery for the study of reconstruction problems, and I do not think I can usefully add anything to that statement at present.

Sir I. Albery: Is it being borne in mind that the interim problems, despite the difficulties of the permanent problems, are even more urgent?

Sir W. Jowitt: Yes, Sir.

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Beveridge Report

Mr. Parker asked the Minister without Portfolio what steps the Government propose to take to carry out the recommendations of the Beveridge Report?

Sir W. Jowitt: I would refer my hon. Friend to the statement which I made to the House on this matter on December 1st last. Consideration of the recommendations of Sir William Beveridge is being actively pursued but no conclusions have yet been reached.

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Ministry of Agriculture and Fisheries

Colonel Carver asked the Prime Minister whether, in view of the growing importance of the fishing industry, he will consider separating the fisheries section of the Ministry of Agriculture and Fisheries from the agricultural and making two Departments?

Mr. Attlee: I would remind my hon. and gallant Friend that there is already a separate Fisheries Department within the Ministry of Agriculture. The appointment of a separate Minister would not be justified.

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Ministry of Production (Scientific Advisers)

Mr. A. Edwards asked the Minister of Production whether the scientific advisers on his staff now report to him instead of through the Lord Privy Seal?

The Minister of Production (Mr. Lyttelton): Yes, Sir. When my right hon. and learned Friend the Minister of Aircraft Production was appointed to his new Department it was arranged that in future the three scientific advisers should report direct to me. I may add that my right hon. Friend the Lord President has agreed that the scientific advisers should also have direct access to the Scientific Advisory Committee, of which my right hon. Friend has recently become the President.

Mr. Salt asked the Prime Minister what changes in the scientific direction and co-ordination of the war effort are involved by the appointment of his personal scientific adviser as Paymaster-General and the transfer of the Lord Privy Seal to the Ministry of Aircraft Production; and whether, in particular, the latter change in any way modifies the arrangements with regard to the link between the scientific advisers to the Ministry of Production?

The Deputy Prime Minister (Mr. Attlee): No changes in the scientific direction and co-ordination of the war effort are involved by the appointments to which my hon. Friend refers. As regards the last part of the Question, I would refer him to the reply which my right hon. Friend the Minister of Production gave yesterday in reply to a Question by my hon. Friend the Member for East Middlesbrough (Mr. A. Edwards).

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Milk Pasteurisation

Dr. Russell Thomas asked the Parliamentary Secretary to the Ministry of Food, in view of the fact that more than 90 per cent. of the milk consumed in the London area is subjected to a process known as pasteurisation and that the number of deaths in London from tuberculosis in children under 15 years of age was 12 per cent. more in 1941 than in 1938, in spite of the reduction in child population in 1941 due to evacuation, will he say what sum was expended by his Department in advertising this prepared milk in 1941?

Mr. Mabane: Nothing was expended by my Department in advertising pasteurised milk in 1941.

Dr. Thomas: Is my hon. Friend aware that the statistics of the Medical Officer of the London County Council show that, in spite of wholesale pasteurisation, the actual death rate from non-pulmonary tuberculosis has increased by 67 per cent. during the war, and that it is much greater than in the country as a whole?

Mr. Mabane: The Question relates to advertising.

Dr. Edith Summerskill: Is the hon. Member aware that the highest medical authorities in the country refute the suggestion which has been made?

Mr. David Adams asked the Parliamentary Secretary to the Ministry of Food whether, with a view to destroying pathogenic organisms in non-pasteurised milk consumed by the population and resulting in widespread disease and deaths, it is now intended that all milk for human consumption will be scientifically pasteurised;

Dr. Russell Thomas asked the Parliamentary Secretary to the Ministry of Food what steps his Department has taken regarding the subject of the general pasteurisation of milk?

Mr. Mabane: The question of the appropriate and practical steps which can be taken to secure the elimination of active tubercle organisms from liquid milk is at present under consideration with the Agriculture and Health Departments and other interests.

Mr. Adams: In view of that evasive answer, which is a repetition of previous answers, I beg to give notice that I will raise this matter on the Adjournment at the first opportunity.

Major Petherick: In view of the controversy about the pasteurisation of milk, will the Parliamentary Secretary arrange for half a dozen doctors to be fed on pasteurised milk and a further half dozen to be fed on non-pasteurised milk, so that we can see what happens?

NOTES AND NEWS

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Feb. 4th.—Meeting of the Central Veterinary Society (Division, N.V.M.A.) at the Conway Hall, Red Lion Square, W.C.1, 2.30 p.m.

Feb. 10th.—Meeting of the Scottish Metropolitan Division, N.V.M.A., at Edinburgh, 2.30 p.m.

Feb. 11th.—Lincolnshire and District Division, N.V.M.A., Annual General Meeting at Grantham, 2 p.m.

Feb. 12th.—Meeting of the Yorkshire Division, N.V.M.A., at Leeds, 2.30 p.m.

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PERSONAL

Mrs. J. F. Craig has had so many messages of sympathy from members of the profession that she feels that she cannot attempt to answer each one personally as she would wish. She would like, therefore, to take this opportunity of expressing her warmest thanks to these friends and societies.

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Old London students will be sorry to learn that Mrs. Bell has been seriously ill. We are pleased to report that her health now gives rise to less anxiety and trust that this improvement will be maintained.

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Forthcoming Marriage. — Steele — Abel. — James Steele, M.R.C.V.S., Animal Health Department, Woodside Lairage, Birkenhead, only son of Mr. David John Steele, late of Langside, Glasgow, to Elizabeth Gibb Abel, daughter of Mr. James Abel, Bulloch Avenue, Giffnock, Renfrewshire.

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Marriage.—Rosenbluth—Howell.—On January 16th, 1943, Eli Rosenbluth, R.E.M.E., son of Dr. Martin Rosenbluth and Mrs. Rosenbluth, of New York, to Deborah Howell, M.R.C.V.S., daughter of the late Brig.-General Philip Howell and Mrs. Howell, of Upshire, Waltham Abbey.

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R.C.V.S. OBITUARY

Eassie, Fitz-Patrick, C.B., C.M.G., D.S.O., Brig.-Gen. A.V.S. (retd.), 13, Ely Place Dublin. Graduated London, December 9th, 1885. Died January 23rd, 1943.

Smart, William Wilkinson, Charlecombe Farm, Charlecombe, nr. Bath. Graduated London, April 8th, 1876. Died January 18th, 1943; aged 87 years.

KINROSS-SHIRE FOAL SHOW

Mr. John F. Watson, M.R.C.V.S., of Milnathort, Hon. Secretary and Treasurer of the above event, informs us that £106 13s. 8d. has been raised from this show—an increase of £60 on last year's figure. The proceeds have been donated to the Red Cross Funds.

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UNIVERSITY OF LONDON EXAMINATIONS IN VETERINARY SCIENCE

The following is the December, 1942, Pass List for the Second Examination in Veterinary Science, University of London: Maguire, Robert Daniel; Parker, Joseph, and Usher, Francis James—all of Glasgow Veterinary College and Anderson College, Glasgow.

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LEGAL NOTES

Bailiff Fined for Obstruction.—Alleged to have got into a "towering rage" with a Ministry of Agriculture official who approached him in connection with foot-and-mouth disease regulations, and to have ordered him off the premises, Reginald H. Goodway, Providence Lane, Corsham, bailiff of a small holding, was summoned for obstructing the Inspector in the execution of his duty.

Mr. Sidney Jones, of Trowbridge, a veterinary surgeon of the Ministry of Agriculture, told the Bench he called on defendant at Providence Lane because he understood that in the course of his Home Guard duties he had entered an infected area, Corsham Park, earlier in the week, and he wanted to examine defendant's cattle. Before he could explain who he was Goodway went into a towering rage and ordered him off the premises. Witness went to the Police and tried to get into touch with Goodway's employer, but was unable to find him. The following day he returned to Providence Lane with P.S. Chivers, and defendant again ordered him to leave.

P.S. Chivers gave evidence that when he went with the Inspector defendant adopted an offensive attitude and used bad language, and he eventually walked away and left them, telling them to milk the cows themselves.

Inspector Perry said that some two months previously, when there was a serious outbreak of foot-and-mouth disease, he had spoken to Goodway and impressed on him the importance of keeping trespassers off his land, as he suspected that people went across there.

Defendant said that it was not until the second visit that he knew the Inspector was a Ministry official. He told him he did not want him to go among the cattle at all, because he had no assurance that he had not been among infected beasts and was not satisfied with the precautions as regards disinfecting. He had had 40 years' experience, and he gave an assurance his cattle were all right.

The Chairman told defendant that the Bench sympathised with the difficulty of carrying out the regulations, and some of them as farmers knew how difficult it was to keep people off the farms. They felt, however, that he rather exceeded himself in his behaviour to the Inspector, but they were going to take a lenient view. this being the first case of the sort before the Bench. He would be fined £2.

* * * * *

CONTROL OF DISEASES OF ANIMALS

The Work of the Ministry's Veterinary Laboratory

[Issued to the Press]

The Ministry's Veterinary Laboratory is part of the Animal Health Division of the Ministry, and is an essential factor in the organisation for the control of animal diseases in this country. Its work may be described as falling into three broad divisions:—

(i) Laboratory diagnosis of scheduled diseases.

(ii) Research into causes and control of diseases of animals.

(iii) Preparation of products for use in the diagnosis and control of diseases of animals.

There is also a branch laboratory situated at Lasswade, Midlothian, established primarily to deal with diseases of poultry in Scotland, but which also furnishes other laboratory services for that country.

1. Many of the contagious diseases of animals are controlled by the application of Acts and Orders. The Ministry's Laboratory is responsible for the diagnosis of all except foot-and-mouth disease when it is necessary to obtain laboratory diagnosis, *e.g.*, anthrax, swine fever, sheep scab, parasitic mange, etc.

2. The important diseases on which research is carried out are:—
Cattle—tuberculosis, contagious abortion, mastitis.
Pigs—swine fever, necrotic enteritis.
Sheep—trace element deficiencies, metabolic derangement, parasitic gastro-enteritis.
Poultry—pullorum disease, fowl paralysis, tuberculosis, coccidiosis.

These are some of the more extensive diseases—there are many others.

3. *Tuberculosis.*—There are two methods of control: (*a*) eradication, (*b*) immunisation. For eradication it is necessary to recognise the infected animal. This is done by application of the tuberculin test. Tuberculin testing has been carried out for many years. Research has enabled a more satisfactory tuberculin to be prepared and alteration in the method of testing has also been found necessary. The Ministry of Agriculture before the war encouraged the formation of herds free from tuberculosis under the Attested Herd Scheme.

Immunisation has been attempted for a long time. It is only recently that methods have been found of value. There are two such methods which are at present undergoing tests in the field.

4. *Contagious Abortion.*—The methods of control are (*a*) eradication, (*b*) immunisation. In eradication it is necessary to diagnose the infected animals by the agglutination blood test. Having established a herd free from abortion, very great precautions are necessary to maintain it free from the disease.

Immunisation is now being largely practised in this country. Living vaccines, which are so altered that they do not infect the animals, are now being used. The vaccine largely used in America is also being used in this country.

5. *Mastitis* in cattle is the cause of much loss of milk. The disease is caused by different types of organisms, but the prevailing type is well known and has been studied thoroughly. While some cases of mastitis are of an acute nature, the majority are chronic and may pass unnoticed if precautions are not taken to recognise it. It is this type that causes the loss of milk. Control measures consist in the treatment of infected cows and in the carrying out of hygienic measures necessary to prevent infection from cow to cow or from outside sources. One type of mastitis gives rise to much trouble in cows not in milk and the infection is probably conveyed by flies.

6. *Swine Fever* causes heavy losses in pig raising areas. Control is governed largely by Acts and Orders. In America a new method of control is being used—crystal violet vaccine—prepared from the blood of infected pigs to which the dye crystal violet is added. The vaccine is not infective, but is protective against infection for several months. The vaccine made by the American method is now the subject of trial in this country. Preliminary results confirm the American findings.

7. *Necrotic enteritis* is a disease of pigs caused by an organism. It may be mistaken for swine fever unless suitable examination is carried out. It is found mostly in young pigs. Methods of husbandry have a considerable bearing on the methods of control. Drugs of the sulphonamide series may prevent infection and if given sufficiently early may effect a cure. Swine fever vaccine will have no preventive effects on necrotic enteritis.

8. *Diets* must contain all the essentials for ensuring health in normal animals and in human beings. For many years the general balance of the majority of the essential components have been well known. More recently it has been shown that very small amounts of many minerals are essential to general health. Good examples of diseases due to mineral deficiencies are found in sheep. "Swayback" in lambs is associated with a deficiency of copper while "pining" in some parts of the country arises from deficiency of cobalt and probably other elements. Very small traces only are necessary for health and the addition to the diet of small amounts makes good the deficiencies.

9. Practically all sheep harbour parasites in the alimentary tract. In many cases no visible damage is done by the parasites—in other cases the disease parasitic gastro-enteritis is set up which may cause heavy mortality and much loss of condition. The control of parasitism consists of:—

(*a*) Sheep husbandry so arranged that the sheep are exposed to re-infestation only to a very slight degree;

(*b*) The use of drugs which destroy the parasites in the alimentary tract;

(*c*) Treatment of the pastures whereby the infective stages of the parasites are destroyed or removed (*e.g.*, grazing by another species of animal).

The use of drugs is largely practised in this country. The new drug, phenothiazine, first used in Canada, has given the most

satisfactory results in sheep. It is superior to other drugs in that it affects many species of parasites and appears to be quite harmless even in large doses.

10. *Pullorum disease* (*B.W.D.*) caused by an organism first discovered in America, is the most prevalent disease in poultry in this country. It affects chicks mostly, but adult stock harbour the organism and may die from the infection. The part played by adult stock is largely concerned with transmission, for infected pullets and hens may lay infected eggs, which, on hatching, mean infected chicks. The control of the disease consists largely in the detection of the infected adult stock in breeding flocks and their removal. This is done by the application of a test—the agglutination test—to the blood of the fowls. There are two methods of carrying out the test: (*a*) in the laboratory (so-called tube test) which necessitates the sending of samples of blood from each fowl to the laboratory; (*b*) on the farm by the "rapid" test, each fowl being tested in turn and a diagnosis being made at once. The rapid test has now been introduced by the Ministry as its official test. It is carried out by Veterinary Inspectors of the Ministry.

11. *Fowl Paralysis* has caused much loss in this country for some years. Recent work shows that the disease may begin in the young chicks and may be transmitted through the egg. It appears to be infective in character and premises, etc., retain the infection. Young chicks do not always die, but may go through a period of unthriftiness following which they may appear to develop normally: they may retain the infection and develop the chronic form in later life, especially at the onset of laying. Enlargement of nerves and tumour formation in organs are the common lesions, while paralysis of legs, wings, etc., is the common symptom. Strains of fowls vary in their susceptibility to the infection—some strains appear to be highly resistant. The only control methods available at present are the selection of resistant stock and the exercising of care to avoid contact between healthy chicks and infected chicks or adult stock on infected premises.

12. *Coccidiosis in poultry* may also be a cause of high mortality and poor growth. The disease is caused by parasites in different parts of the intestine and the species of the parasite and the part of the intestine involved decide the nature of the outbreak. Control measures consist in preventing exposure of the young stock to heavy and repeated infestations. A knowledge of the life history of the parasites determines the nature of the control measure. There are two main types of coccidia infesting poultry—one found in young growing fowls and the other in older stock. Quite recently in this country and in America it has been shown that drugs of the sulphonamide series are valuable in preventing infestation with coccidia and it is hoped that soon the method will be brought into practice.

13. The Ministry of Agriculture is playing a considerable part in the new scheme for the control of diseases in dairy cattle. In addition to the work carried out by the Veterinary Inspectors in collaboration with veterinary practitioners the Ministry provides a free supply of vaccine for the control of contagious abortion and also sulphanilamide at much reduced cost for use in cases of mastitis. In addition, the Ministry has supported measures for the tuition of veterinary practitioners in methods for the control of sterility in cattle.

14. At the present time in this country vaccines and sera (biological products) can be produced in any laboratory and under uncontrolled conditions. Measures are about to be taken to control their production and to set up standards to which they must conform. The measures will be under the control of the Ministry of Agriculture.

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SCIENCE IN FARMING

In the first of the series of lectures on "Agriculture to-day and to-morrow," arranged by the Royal Society of Arts, Mr. Anthony Hurd spoke on the attitude of the farmer to research and agricultural science.

Mr. Hurd said that we were fortunate in this country in having a strong tradition of good farming. Our farmers clung to practices that through generations had kept the land in good heart, and they meant their sons to follow them in farms worth farming. Grafted on to this good husbandry, science was being applied with great effect to obtain the present remarkable expansion in food production.

Thanks to the war agricultural committees, up-to-date technical advice was reaching every farm, and almost always the advice was welcome. But the channels for the flow of new knowledge from the research institute and experimental station to the farm were not wide enough. At present there were such bodies as the Agricultural Research Council, the Ministry itself, Weybridge, Askham Bryan and Compton. Surely it would be plainer sailing for all concerned if one body controlled the organisation and finance of agricultural research. Recently an Agricultural Improvement Council for England and Wales had been set up appointed by the Minister and there was a similar body for Scotland. This arrangement would, they might hope, tie up research more closely with the farmer. Before this war it was doubtful whether one in five of the 300,000 farmers in the United Kingdom was in regular touch with the county agricultural organisers or advisory staffs. As soon as conditions allowed there must be a big extension of agricultural education. Mr. Hurd hoped that the day would soon come when an agricultural degree or diploma would be required as a necessary qualification by the landowner selecting a new tenant.

In the stress of war British farmers had discovered what could be done with modern equipment, and the nation was beginning to understand. But farmers must be fully masters of their job. By harnessing research and technical education still more closely to farming practice British farmers could continue in peace as well as in war to supply a large part of the nation's food.

Farmers would, Mr. Hurd said, require from the nation a guarantee of steady markets and the nation would require from them a guarantee of all-round efficiency.

* * * * *

The Secretary of State for the Colonies has approved a recommendation of the Colonial Advisory Council of Agriculture and Animal Health that its functions should be extended to include forestry. The Council will accordingly in future be known as the Colonial Advisory Council of Agriculture, Animal Health, and Forestry. Additional members will be appointed to the Council to advise on forestry matters, and a Forestry Committee will shortly be set up, parallel to the existing committees of the Council which deal with agriculture and animal health. The Duke of Devonshire, as successor to Mr. Harold Macmillan, Parliamentary Under Secretary of State for the Colonies, has assumed chairmanship of this Council; the Vice-Chairman is Mr. G. L. M. Clauson, C.M.G., O.B.E., Assistant Under Secretary of State.

CORRESPONDENCE

Letters to the Editor should reach the Office not later than by the first post on Monday morning for insertion in following Saturday's issue.

The views expressed in letters addressed to the Editor represent the personal view of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

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THE NEW VETERINARY BILL

Sir,—I have just read Mr. E. P. Edwards's letter in your issue of January 23rd and would like the opportunity of correcting certain misapprehensions, that if left unanswered might lead to the impression that he is giving to others who read the letter, that I concur with all his statements about my views.

First, let me assure Mr. Edwards that I have been as anxious as he to postpone comment on the draft Bill before Council, R.C.V.S., until they have agreed to the form in which we are to consider it. The views I hold and the opinions that I have had the temerity to express are those of a general practitioner as much in the dark as he is. And I only expressed my views and presented one possible alternative to my fellow practitioners because certain things that were happening around me led me to believe that a state of such emergency existed as only candid discussion could relieve. The sum of my information when I composed my presidential address to the Society of Veterinary Practitioners was this: that there was a draft Bill before Council, R.C.V.S., endeavouring to regulate and control the undesirable activities of *certain* unqualified practitioners; that the means proposed for achieving this end was the registration of a certain number of the lay workers employed by humane organisations in their clinics. Let me emphasise that this was not first hand information given me by anyone, but persistent and consistent rumour given out in course of conversation with many worried and puzzled veterinary surgeons. In common with these latter I agreed and still agree that if true then this course of action was deplorable and calculated to put the clock of progress back again to the position it was half a century ago. One does not cure a malignant tumour by grafting another alongside of it! Moreover, strong colour was lent to the veracity of this rumour by a deplorable leakage on the part of someone—and I am sure it was not an "inside job"—which has led to certain quacks up and down the country putting up their plates in the

hope that they will be in time for the day when registration is available to them. It is within my personal knowledge that quacks are strengthening their hold over clients by informing them that within a short time they will possess licences to practise issued by the R.C.V.S.

Now this latter is a pretty grim state of affairs and, rightly or wrongly, as leader, at the time, of my fellow practitioners, I deemed it my duty to bring the position into the light of day. After a great deal of thought I believed that I had found a way of doing this, that in no way conflicted with the undoubted right of the R.C.V.S. to consider the matter in their own way and in their own time. It was to present an alternative line of approach to the quackery problem. Here let me correct Mr. Edwards's inference that I knew or thought that the Bill was attempting to create a licentiate degree. That was my own idea entirely, put forward as an alternative line of approach to the problem. I think if my address is read carefully it will be seen that in the suggestions put forward there is the implicit axiom that any future attempt to control quackery must control *all* quackery. No piecemeal or sectional control will be of any value whatever. I am open to conversion, I am more than eager to see alternative schemes for achieving an objective we all know to be salutary and desirable, but frankly, in my blindness and vanity, I think my suggestions as a basis for discussion are the best to date, and certainly far more worthy of consideration as one way of dealing with this problem than those that Dame Rumour has foisted upon Council, R.C.V.S. I must here point out that my suggestions as to the training of lay workers, which is the thorny core of my thesis, represent a procedure that has already proved a workable and successful one, notably in Russia, in our Dominions and Colonies, and has in fact enhanced the prestige and eased the lot of the highly trained veterinarian. Where would the medical profession be without its licensed and trained helpers, the nurses, the laboratory worker without his lay assistants, the lawyer and his clerk? One could multiply instances of this modus operandi and the benefits it brings.

It may well be that by the time this letter is in print the R.C.V.S. will have circulated their draft Bill, and this letter may then look distinctly comic, but I am anxious that my present views should be cleared from the inaccuracies and suspicions that my clumsiness of expression has created in the minds of those who are as anxious and jealous as myself that the rights and prerogatives of our members suffer no encroachment or diminution.

Yours faithfully,

Beaconsfield. R. C. G. Hancock.

January 25th, 1943.

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Sir,—May I briefly reply to the letter from Mr. E. P. Edwards. The draft Bill has never contained any provision for the training of "sub-veterinary workers," and the Council has never contemplated granting a "licence degree" to any such persons. At the recent meeting at York certain amendments were made to the draft and as soon as these have been put into proper shape by the Parliamentary draftsman the Bill will be circulated to the profession.

Yours faithfully,

Fred Bullock,
Secretary.

Royal College of Veterinary Surgeons,
18, Victoria Avenue,
Harrogate.

January 25th, 1943.

* * * * *

FERTILITY AND INFERTILITY IN THE COW

Sir,—Several statements in Mr. Smythe's paper on the above subject in your issue of January 9th seem likely to give rise to misunderstanding. I should like to submit the following comments:—

1. On the *diagnosis of pregnancy at* 6-8 *weeks* the essayist says "the non-gravid horn remains firm to the touch, whilst the gravid horn feels thinner and contains a small amount of fluid which travels along the horn in front of the finger when the horn is gently stroked." This statement is somewhat vague and misleading. By the end of the eighth week the non-gravid horn as well as the gravid horn almost invariably contains fluid and its walls have also become thin. Even during the latter part of the seventh week the non-gravid horn usually contains a certain amount of fluid detectable on rectal palpation.

2. When speaking of *pyometra* Mr. Smythe says that several observers have recorded fremitus in the middle uterine artery in this condition. To my knowledge this phenomenon has been reported only by Rowson and Spriggs working in collaboration. Without questioning the undoubted ability of these two workers, it is the considered opinion of the majority of experienced veterinary gynaecologists that the case reported was not thoroughly substantiated and that, until contrary evidence is forthcoming, fremitus in the middle uterine artery may be taken as definite evidence of pregnancy.

3. "Other indications of pregnancy, such as . . . *pulsation or fremitus* in the arteries." I have no reason to doubt that, in his own mind, the essayist clearly distinguishes between pulsation and fremitus. In that event it would be advisable to point out that mere pulsation in the uterine arteries is not diagnostic of pregnancy being normally present in the non-pregnant as well as in the pregnant animal.

4. "Normally, in the cow the *corpus luteum of pregnancy* regresses at about four to five weeks after parturition." This statement is entirely erroneous. Investigations in progress have shown that the corpus luteum of pregnancy is no longer readily detectable on rectal examination by the end of the first week *post-partum*. In some cases it is not detectable two days *post-partum*. It is probable that regression begins some considerable time before the end of gestation and there is reason to believe that by the latter time the corpus luteum is already practically functionless as a progesterone-secreting organ.

5. Mr. Smythe assumes the existence of the condition "*corpus luteum persistens*." While it is possible, and perhaps even probable, that this condition does exist apart from pyometra, the point has never been undeniably established. Until this condition has been proved to exist we have no right to assume its existence.

6. Dealing with examination of the *fallopian tubes and ovarian bursac* the essayist says "the fallopian tube runs along the free border of the pouch." This is not so. On the contrary, the fallopian tube is to be found about mid-way between the free and attached edges of the mesosalpinx. It can usually be felt distinctly per rectum.

7. *Trichomoniasis*.—With regard to this disease Mr. Smythe indulges in what appears to be a campaign of "drawing red herrings across the track." He seems unwilling to face up to the fact that this is recognised—not only in this country but also abroad—as one of the most important reproductive diseases of cattle. Undoubtedly there may be many factors implicated in outbreaks of the disease—as there are with many infectious diseases—but there is now no question about (*a*) the causal organism and (*b*) the ability of experimentalists to reproduce the disease by the introduction of pure culture of the organism into animals.

The letter from Mr. L. E. Rowson quoted by the essayist proves nothing. It suggests that: (*a*) infection with *corynebacterium pyogenes* may be confused clinically with trichomoniasis, or (*b*) that the two conditions may occur in the same herd. Both of these facts have been recognised for some time, as also has the fact that the parasite is not always readily demonstrable microscopically. The statement that trichomoniasis may *seem* to appear spontaneously is not, of course, the same as that it *does* appear spontaneously. The possibility of infection from a neighbour's bull or cow or the existence of carrier animals in the herd may provide the solution to such apparent spontaneity of appearance.

8. With regard to the use of *pregnant mare serum*, Mr. Smythe says "it is important before using this agent to ascertain that true anoestrus exists, that the C.L. present is not associated with pregnancy." At present it is recommended that p.m.s. should be used only in animals showing by rectal examination no ovarian cycle. On that account it should *not* be given to animals in which corpus luteum formation is occurring.

At a time when research into the endocrine control of the oestral cycle is being systematically and energetically pursued it is desirable that hormone preparations should be used with great care and *only* in the type of case for which they are recommended.

It is very disappointing to read a paper by a clinician of such standing and to find it contain so many erroneous and nebulous statements. Far from being an aid to the understanding of fertility and infertility in the cow, it seems to me that Mr. Smythe's paper may make "confusion worse confounded."

I am,
Yours faithfully,

Calvington Farm House, J. G. Murray.
nr. Newport,
Salop.

January 12th, 1943.

* * * * *

Sir,—Mr. Scorgie contributes usefully to the discussion, but begs some questions about what we ought to expect from breeding cattle. I think that there is need to reconsider our attitude to the matter of fertility/infertility. One gathers from Mr. Scorgie that cows of beef breeds do not breed in the winter and are not

expected to do so. They are accordingly not stigmatised as infertile like their unhappy dairy breed cousins, which do contrive to breed in the winter, though not enough to satisfy some people.

What standard of breeding ability have we a right to expect? I suggest that the common complaint that cows fail to settle in calf soon after calving is altogether unjustified and that the standard of breeding ability which that envisages is altogether too high. By the same token estimates of pecuniary loss which are sometimes made, based on a standard implying incessant breeding activity in cows, are unnatural and ridiculous. The bogy of infertility vanishes as the standard is lowered to a natural level.

No further appreciable advance in the breeding of animals for increased productivity is to be expected, as the cattle of to-day are themselves the end-products of past breeding policies. They are also the end-products of disease-resistant strains, the less resistant having already passed out to a great extent. Professor Goetze, of Hanover, has had something interesting to say about that in recent years.

It is all a matter of having one's cake and eating it. The current average level of herd wastage indicates that the cake is being heavily eaten into. The choice is plain—either exploit cattle to the utmost and ignore herd wastage or control herd wastage by reducing the stress on the animals. In this connection I would refer your readers to Mr. Smythe's outstandingly wise essay, printed in No. 2 of this year's *Record*.

Yours faithfully,

West Byfleet. J. Edwards.
January 14th, 1943.

* * * * *

CRAMP IN THE GREYHOUND

Sir,—Whilst Mr. Male's chief objects in writing his article were to draw the attention of his colleagues attending greyhounds to the cramp produced by strychnine, my contribution was written with the express purpose of protecting my fellows from the tendency to consider cramp in the greyhound as most likely to be due to dope. It is our business to keep a watchful eye for malpractice, but cramp does appear in well run kennels in the absence of drug interference, and may even be fairly common at periods, depending on the degree of fitness, temperament of individuals and duration of kennelling.

Having recorded my observations, I hope to take early steps to interest some physiologist who may be able to interpret the onset of the symptoms in the normal animal.

Meanwhile, might I explain to Mr. Male that my interpretation of the onset of non-sweating disease was that heat and probably other factors reduced the skin of the horse to a state in which it could not perspire—in other words, to a state akin to the skin of the dog which did not require atmospheric heat to reduce it to that state. Further, most veterinary surgeons acquainted with greyhounds will appreciate that 12 hours' kennelling in the home kennels bears no relationship whatever to three or more hours' kennelling of a greyhound within sight or earshot of an electric hare going round the track every quarter of an hour.

Yours faithfully,

The Hook Kennels, Jas. K. Bateman.
Northaw,
Potters Bar,
Middlesex.
January 20th, 1943.

* * * * *

COPPER SULPHATE TOLERANCE OF SHEEP

Sir,—It was with more than usual interest that I read of Colonel Rees-Mogg's two fatalities in lambs when drenching them with 30 grains copper sulphate in combination with nicotine sulphate solution. The following case, with which I was brought into contact 18 months ago, indicates that 35 grains copper sulphate in solution may cause a high mortality on its own.

Thirty-eight lambs, 3 to 4 months old, in a flock which had had several deaths from parasitic gastro-enteritis, had been drenched with supposedly 1 oz. 1 per cent. copper sulphate solution in 5 oz. water each. Analysis later revealed this to be in actual fact a 7·2 per cent. solution, so that each animal was receiving 35 grains copper sulphate. Twelve were dead within six hours and another 12 at varying periods up to ten days, 63 per cent. succumbing in all. Early autopsies revealed no macroscopic changes at all, but one lamb that died after eight days showed a severe fibrinous abomasitis, slight enteritis in the small intestine, fatty changes in the liver and kidneys with petechiation in the latter, red hepatisation in the lungs, and blood-stained fluid in the peritoneal cavity.

Diarrhoea and evidence of pain were conspicuous by their absence, the most universal symptoms being anorexia, extreme dullness and disinclination to move, although a few showed some degree of anaemia and pyrexia.

The owner remarked afterwards that the survivors thrived exceedingly well, this presumably being due to a combination of two factors, the efficiency of the vermifuge (possibly with a "tonic" effect as well) and the survival of the fittest.

Yours faithfully,

The University, D. N. Spriggs.
Reading.
January 24th, 1943.

* * * * *

LEAD POISONING OF CATTLE FROM SALVAGED GROUND-NUT FOODSTUFFS

Sir,—In view of the use of damaged or salvaged foodstuffs as a result of war-time difficulties, the following two cases, both of which have been encountered within the last few days, appear to be of sufficient importance to record.

1. After two weeks of feeding on a mixture of salvaged ground-nut meal (*Arachis hypogea*), rolled oats and beet pulp, several bullocks developed salivation, defective vision and inco-ordination of movement. Within three days of the onset three had died and 15 more were affected, fresh cases occurring each day. Chemical analysis of the liver from a fatal case revealed the presence of lead (1/100 grain per ounce).

The salvaged ground-nut meal consisted of a finely ground dark brown damp powder with a smell suggestive of cocoa. Microscopically it consisted of seed endosperm with no characteristic tissue. It had the appearance of having fermented. On chemical analysis the meal was found to contain approximately one-and-a-half grains of lead per ounce.

2. A group of cattle was fed with a salvaged ground-nut (*Arachis hypogea*) feeding-stuff (sold as "water-damaged"). A number of the cattle developed "loss of control of the jaws and tongue" and defective vision. Three were slaughtered and the carcases were passed as fit for human food, no abnormality having been found at *post-mortem* examination.

The ground-nut food came from a store which had been "blitzed." It consisted of dark brown somewhat charred and broken ground-nuts having a cocoa-like smell. On chemical analysis approximately $\frac{1}{4}$ of a grain of lead per ounce was detected in the sample.

Yours faithfully,

529a, Finchley Road, Arthur B. Orr.
London, N.W.3.
January 14th, 1943.

DISEASES OF ANIMALS ACTS, 1894 TO 1937, AND AGRICULTURE ACT, 1937 (PART IV).

Summary of Returns of Confirmed Outbreaks of Scheduled (Notifiable) Diseases

Period	Anthrax	Foot-and-mouth	Parasitic Mange*	Sheep Scab	Swine Fever
Dec. 16th to 31st, 1942	24	8	1	18	17
Corresponding period in—					
1941 ...	12	—	1	44	24
1940 ...	20	42	—	31	170
1939 ...	17	12	3	14	159
Total Jan. 1st to Dec.31, 1942	362	670	28	283	451
Corresponding period in—					
1941 ...	399	264	21	255	1,088
1940 ...	564	160	19	228	5,019
1939 ...	690	99	36	276	3,286

Note.—The figures for the current year are approximate only.
*Excluding outbreaks in Army Horses.

Tuberculosis (Attested Herds) Schemes

The number of Attested Herds, *i.e.*, herds officially certified as free from Tuberculosis as at December 31st, 1942, was as follows :—

England	Wales	Scotland	Total (Great Britain)
3,911	8,844	3,390	16,145